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An analysis of the relationship of work experience requirements to written and practical vocational competency examination scores of Massachusetts vocational teachers.

Joyce C. Beach
University of Massachusetts Amherst

AN ANALYSIS OF THE RELATIONSHIP OF WORK EXPERIENCE REQUIREMENTS TO WRITTEN AND PRACTICAL VOCATIONAL COMPETENCY EXAMINATION SCORES OF MASSACHSETTS VOCATIONAL TEACHERS

A Dissertation Presented

BY

JOYCE PERRY CASSON BEACH

Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements for the degree of

DOCTOR OF EDUCATION

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School of Education

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DEDICATION

This book is lovingly dedicated to my son,

WILLIAM MICHAEL CASSON

in appreciation of his moral support, and for his technical support as the programmer on this project.

ACKNOWLEDGEMENT

There were many people who assisted and encouraged me in the development of this dissertation and to whom I own a debt of gratitude and appreciation.

Professor Kenneth Ertel, my Chairperson, was invaluable throughout the process, but especially helpful in the final days clearing away what seemed insurmountable obstacles at the time.

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Professor Frank Lattuca was most helpful when it counted the most.

A special vote of thanks is due to the more than one hundred test developers and examiners throughout the Commonwealth of Massachussetts who have participated in the Vocational Competency Testing Program since its inception. Their devotion to insuring and maintaining the excellence of vocational education in Massachusetts is deeply appreciated.

I am greatly indebted to my assistant, Dolly Wright, who managed to keep my spirits up even when the task seemed impossible.

Finally, to my husband, Ned, I owe you two years of home cooked meals to make up for all the TV dinners you have consumed without complaint.

A B S T R A C T

An Analysis of the Relationship of Work Experience Requirements to Written and Practical Vocational Competency Examination Scores of Massachusetts Vocational Teachers

May 1985

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This four year study was undertaken to assess the strength and direction of the relationship between the number of years of occupational experience and the scores on the Massachusetts Vocational Competency Examinations of candidates for vocational teacher approval in the Commonwealth of Massachusetts. Further, the relationship between educational background and teaching experience and test scores were investigated. Finally, the relationship between all three factors and test scores was studied.

The scores on both the written and practical examinations and responses to the questions on the Demographic Questionnaire of four hundred and three candidates were analyzed. Using regression analysis, one experience from each of the three groups (work

experience, teaching experience, and educational background) was selected. Then these three factors were analyzed to determine their relationship to test scores separately and when acting together.

Next, a sample of seven trades was taken, and Chi-square analysis was used to determine whether passing or failing the written and practical examinations was independent of work experience, teaching experience, and educational background.

The result of this analysis was that test scores were significantly related to educational background and teaching experience, but not work experience. The teaching experience that was significantly related to written test scores was found to be the number of years teaching occupational, technical business or industrial arts courses at the secondary level. The teaching experience related to scores on the practical examination was the number of years teaching vocational courses in the trade area of the test. The educational background that was significantly related to practical test scores was the number of years of formal education. the educational background that was significantly related to the practical test scores was the amount of training the candidate had in nondegree programs such as apprenticeships, on-the-job training, or professional institutes.

Although much of this research is inconclusive, it points the way for future research. Based on the findings, several recommendations are made with regard to the eligibility requirements for vocational teacher approval.

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CHAPTER I

INTRODUCTION

Statement of the Problem

A critical shortage of vocationally approved trade and industry teachers exists in Massachusetts in several occupational areas. It is the responsibility of the Office of Professional Development, Division of Occupational Education to maintain a pool of qualified and approved teachers to meet the requirements of Chapter 74 schools and programs throughout the Commonwealth. However, in the Spring of 1984, fifty percent or more of the candidates in fourteen of the forty-two occupational areas subject to the Massachusetts Vocational Competency Testing Program were teaching on a Temporary Conditional Approval.

Vocational Teacher Approval

Candidates for Vocational Teacher Approval must satisfy a six-year work experience requirement and pass a vocational competency examination in their trade area. When such provisionally approved teachers are not available to a school system, the hiring superintendent may employ any one of his/her choice, and apply to the Division of Occupational Education for a Temporary Conditional Approval status for the new employee.

This is an age when standards are being upgraded; people are tired of sloppy workmanship and lack of old-fashioned craftsmanship. Vocational education in Massachusetts has always been in the forefront of the fight to maintain high standards. Suddenly vocational education finds itself in fashion today because of its high standards for credentialing teachers and the competency-based testing used to determine if an individual meets those standards. However, the amount of work experience required may be an inappropriate standard and this is in need of clarification. Are potentially good teachers being denied a chance to teach because they do not meet the work experience requirements?

Work Experience Requirement

The question of how many years of work experience is appropriate has plagued vocational educators for years. The assumption is that the more experience that one has in the field, the better qualified that person will be to teach those skills. Massachusetts has held rigidly to the requirement of six years of recent full-time experience for all vocational trade and industrial education teachers regardless of the trade area. No factual information exists on how many years of trade experience is appropriate for auto mechanics teachers as compared to electronics teachers. Are we to assume that the auto mechanic learns his/her trade in the same amount of time as a lisenced electrician and that s/he learns it with the same depth and breadth of knowledge as a carpenter?

The present Massachusetts requirement of six years of trade experience was reduced from an eight-year requirement several years ago. When this requirement was lessened, many vocational educators were upset and loudly proclaimed that the quality of vocational education would suffer greatly. But recent results of a Department of Education study (1982) show that employers are very satisfied with graduates of the vocational schools in Massachusetts, and yet, the researchers have been unsuccessful in correlating the years of work experience with scores on occupational competency examinations.

Studies of Work Experience and Occupational Competence

A study conducted by the Department of Education, Pennsylvania State University and reported by Garner and Welch (1974) compared years of work experience with scores on both parts of the competency tests given in Pennsylvania at that time. No correlation was found between the number of years experience and scores on written and performance examinations and the average of these two scores. In a study of trade competency, Impellitteri (1965) found a low negative correlation on scores on competency exams and occupational experience. Studies by Rumpf (1954) and Kapes and Pawloski (1964) suggest that occupational experience and teaching scores have little positive relationship, but both of those studies indicated that the more college credit the teacher had the better his/her performance was as a teacher. Other studies, Ellis (1968), Spaulding (1971), Milan (1972) , and Lacy (1973) concluded that work experience beyond the minimum

requirement of 2 to 4 years had no positive impact on teacher success. McAlister (1973) investigated the years of occupational experience in relation to the scores on the state occupational exam in Pennsylvania. This study focused on vocational teachers entering into the teaching field from 1944 to 1973 and concluded that increased amounts of occupational experience did not insure higher test scores. The optimal amount of experience appeared to be 6 to 8 years. Occupational experience beyond that point seemed to have not positive impact.

Formation of the National Occupational Competency Testing Institute

In May of 1971, Gordon McMann of Rutgers University, via a grant from the U.S. Office of Education, set up a consortium of states which indicated a desire to participate in a national occupational competency testing project. He stated:

> " In several meetings held relative to this project, it has become apparent that these states are extremely concerned about the need for better selection techniques for prospective teachers. Although several states have exerted considerable effort and spent sizeable sums to develop and perfect occupational competency tests that may be used to evaluate prospective teachers, everyone's concern has been forced to recognize that the size of the task has been almost beyond comprehension."

This consortium became known as the National Occupational Competency Testing Institute (NOCTI). This consortium is a non-profit educational corporation organized in June 1973 with headquarters originally at Albany, New York and presently located at Ferris State University,

Michigan.

Currently there are 46 states and the District of Columbia in the program as a consortium of states governed by the Board of Directors. NOCTI was created in an effort to provide a uniform national occupational competency program to serve vocational educators on a permanent basis.

NOCTI is the national leader in the industry of vocational competency testing. As of December 1981, in data presented to the American Vocational Association in Atlanta, Georgia, the following states require NOCTI examinations prior to certification; Arkansas, Districk of Columbia, Georgian, Maryland, Oklahoma, Pennsylvania, Puerto Rico. and Rhode Island, However, 28 states also give the NOCTI examination at various state universities and a variable amount of credit is allowed both for degree completion and initial certification. Forty-eight states were surveyed and forty responded.

Finally, the NOCTI News of Spring 1982, reflects on its own history.

> "The National Occupational Competency Testing Institute will soon be 7 years old. The founders of NOCTI were very concerned with those elements which promote and assure quality of all vocational technical education. Their first undertaking was the establishment of competency tests for prospective teachers which evaluated both the cognitive and psychomotor capabilities of the applicant. These instruments have been developed and are now being utilized in more than 60 colleges and universities in the majority of the states."

NOCTI Studies

Two recent studies have dealt with the issue of the relationship of work experience and occupational competence. Both studies rely on data collected by the National Occupational Competency Testing Institute, but the emphasis of each study was different.

Abrams (1981) directed his efforts toward a population made up of Kentucky teachers who completed NOCTI exams between the Fall of 1979 and 1980. This population was not separated by trade. Abrams found no significant relationship between the background characteristics, education, years of work experience, and number of places worked, and level of teaching and occupational competency as measured by the NOCTI exam.

Whitener (1981), however, drew a sample from all NOCTI exam candidates from Spring 1974 to Fall 1980. This sample was then restricted to four particular trade areas. Those trade areas studied were: auto mechanics, machine trades, carpentry, and quantity food service. Whitener found little or no relationship between occupational competence as measured by the NOCTI exam and occupational experience, teaching experience level, and these factors taken together. This study separated out each trade and examined the factors extensively within the trade area.

Certainly, these findings and the others cited above struck at the roots of vocational and occupational requirements for credentialing teachers. The fundamental requirement of most states is that if teachers are to teach the skills of the trade, these skills

must have been learned in the trade itself or in a classroom of related instruction. The natural assumption is that the more time spent in the field, the better the candidate will perform on the credentialing examination.

Purpose of the Study

Primary purpose

The primary purpose of this study was to determine the strength and direction of the relationship between the occupational competence of the candidate for vocational teacher approval as measured by his/her scores on the Massachusetts Vocational Competency Examinations and the number of years of occupational experience of the individual.

Secondary purpose

The secondary purpose was to establish whether or not there is a relationship between teaching experience, educational background and scores on the Massachusetts Vocational Competency Examinations. An examination of several kinds of teaching experiences, and a variety of educational backgrounds was necessary to establish which one, respectively, was the most influential with regard to examinations scores.

Demographic questionnaire

At the time of the administration of the written examination each

candidate filled out a demographic questionnaire which asked for the number of years of occupational experience. Responses are categorized in blocks of time: less than 6 years; 6 to 8 years; 8 to 10 years; 10 to 12 years; and more than 12 years. Although the candidate volunteers this information, it has been verified by letters from employers and others who signify that the candiate has at least six years of trade experience. Information on the person's educational level and teaching experience is also requested at the same time. Further information on the obtaining and treatment of this data is given in Chapter III.

Research questions

There were several research questions to be answered.

First, what relationship existed between the number of years of work experience and scores on the Massachusetts Vocational Competency examinations?

Second, what relationship existed between the amount and kind of teaching experience the candidate has and his/her scores on the Massachusetts Vocational Competency Examinations?

Third, what was the relationship between the candidate's educational level and scores on the Massachusetts Vocational Competency Examinations?

Finally, was there a relationship between all of these factors taken together and scores on the Massachusetts Vocational Competency Examinations?

Candidate profile

The ultimate purpose of this study was to provide a profile of the successful candidate on the Massachusetts Vocational Competency Examinations. This profile was composed of three components: work experience, teaching experience, and educational background.

Significance of the Study

The data obtained from this study should provide the Division of Occupational Education, Department of Education of Massachusetts with information which will contribute to the formulation of a revised policy on the credentialing of Trade and Industry teachers for Chapter 74 schools and programs.

The present system calls for one individual to make decisions on a case by case basis about the validity of the work experience without regard for trade or any other background characteristics of the candidate. It is hoped that the data contained in this study will contribute to a more knowledgable decision as to the eligibility of the candidate for Provisional Approval.

Superintendents and school committees may have to employ teachers who are not credentialed. The superintendent or schoolcommittee assumes an element of risk when hiring such an individual. It is hoped that the data in this study will help to reduce some of the unknowns, and aid in making informed decisions.

Limitation of the Study

The results of this study cannot be generalized to a population beyond the Commonwealth of Massachusetts. The examinations used in this study are developed, validated, and administered entirely within the Commonwealth of Massachusetts. They are intended for use only by

the Division of Occupational Education, Department of Education for the purpose of credentialing Massachusetts teachers, and are not available to any other agency or person.

Definition of Terms

For the purposes of this study, the following terms shall be defined:

Approval. Approval is the term used by the Division of Occupational Education, Department of Education to signify the credentialing or certification of a teacher under Chapter 74 regulations of the General Laws of the Commonwealth of Massachusetts.

Temporary Conditional Approval.Sometimes referred to as a waiver, a TCA may be granted by the Division of Occupational Education for a period of one year. It is the responsibility of the hiring superintendent requesting the waiver to show that no previously approved teachers are available for the position. It is the responsibility of the candidate to register for and complete the examination process during the year of the waiver. It is unlikely that the Division would issue a second or third waiver for the same candidate, except in trades where a critical shortage of teachers exists.

Occupational experience.Occupational experience is measured in this study by the number of years a candidate had worked in the trade area of the test.

Teaching experience. Teaching experience is measured in this study by the number of years a candidate has taught in the areas requested in the demographic questionnaire.

Educational background. Educational background is measured in this study by the responses to the questions about education in the demographic questionnaire.

Occupational education. Occupational education is an umbrella term which includs: Agricultural Education, Home Economics, Business, Health, Technical Education, Guidance, and Industrial Arts as well as Trade and Industrial Education.

Vocational education. Vocational education is that segment of Occupational Education as practiced in Chapter 74 funded schools and programs in Massachusetts; primarily trade and industrial programs.

NOCTI. National Occupational Competency Testing Institute

AIR. American Institute for Research

CHAPTER II

REVIEW OF LITERATURE

The Need for Work Experience

The issue of work experience in trade and industrial education has been one of the major concerns since the early days in vocational education in America. Melvin Barlow in the History of Industrial Education in the United States (1967) states: "One of the most difficult problems in teacher education has been the relationship between trade experience and academic training. There are many evidences of a narrowing interpretation and throughout the years the relationships have been beset with conflict."

Kapes and Pawlowski, Characteristics of Vocational Technical Instructors and the Relationship of Student Shop Achievement, Pennsylvania State University,(1974), supported this lack of concensus when they stated: "There are those who believe that practical experience in industry plus a minimum of pedigodical preparation will produce the most effective teacher. Others believe that those graduating from a teacher training institution with a minimum of industrial experience will produce better results. There

are still others who believe the years of occupational experience is equated with occupational competency."

Rask & Wyatt, 1976, after conducting an extensive national review of research relative to occupational experience requirements in vocational education, concluded: "To a great extent what is required in the matter of occupational experience is still based on opinion and tradition rather than factual research findings. It was found that many offer the necessity of occupational experience of vocational instructors but that little research has been reported on it or related topics."

Three Requirements for Certification of Vocational Instructors

Skill level, literacy, and training are reflected in a dissertation by Scott Douglas Whitener, University of Michigan, (1981): "Historically the educational community has been concerned with vocational trade and industry instructor's occupational experience, technical competence, and educational level. This concern is evident when examining the minimum eligibility requirements each state has established for the selection and certification of vocational trade and industry teachers."

And again, in a dissertation submitted in 1981 by Ronald Abrams, Bowling Green State University: "Certification requirements for vocational teachers in most states and territories have three major components--professional education requirements, technical requirements, and occupational experience requirements.

These recommendations traditionally have been stated in terms of degrees or specific course requirements and the number of years or total hours of work experience. While each of these three major components are considered essential for success in vocational trade and industrial education, there is little concensus about their value and importance and the appropriate amounts in relation to the above."

Valid work experience, college credits in education, and competency testing are the three steps toward vocational teacher approval in the State of Massachusetts.

In 1976 the Massachusetts Board of Education published polices on education placing identification and initial preparation of personnel, continuing professional development, and leadership development of occupational education within the jurisdiction of the Office of Professional Development. Several studies were funded at that time.

Among them was the work conducted by Resnick and Gardner at Boston University. In September (1977), they reported on a survey of vocational teacher and administrator certification requirements across the United States. They mailed questionnaires to 50 state personnel development coordinators for vocational education. The return rate for the forms was 82 percent. Data obtained included: years of work experience required for certification, semester credits required, semester hours or degree requirements, number of states with performance examinations required, academic requirements for admission to trade and industrial examinations, summary of examination formats, development, administration, and grading of the exams, and functions

of professional development personnel. In reviewing the results of the Resnick and Gardner study,38 states responded to the question of years of experience required for certification. The mean requirement was 3.7 years. (Abstracted from information contained in Resnick, Harold S. and Gardner, An Analysis of National Certification Requirements of Professional Development Standards for Vocational Education Personnel September 1977)

At the same time, other states were concerned with the same issue. In another study, Kenneth Simons, (1977), surveyed 54 directors of vocational education. Of these, 40 responded, and of the 40, eighteen indicated that 5 years of work experience was required for certification. Simons figures showed that with 18 responses, 4 required 3 years, 1 required 4 years, 4 required 5 years and 9 required more than 5 years (K.L. Simons, Status & Trends of Occupational Competency Testing on the National Level with Implications for the State of Mississippi, 1977.)

Looking at individual states from A Manual and Standards Affecting School Personnel in the United States some selected states have requirements as follows: Alabama required 7 years of experience in the trade or graduation from an approved trade school or high school with three years experience; Alaska required 4 or more years of experience; California requirements stated simply that appropriate experience and course preparation was all that was required; Colorado required 5 or more years of experience; Connecticut required 8 years for trade instructors, 3 years for related

instructors; Delaware required a high school diploma and 2 years experience; Kentucky required 3 years of successful and appropriate occupational experience in the teaching area; Maine's requirement was as follows: high school diploma or equivalent, industrial experience, apprenticeship or 3 years work experience, or 60 hours in education including 20 related technical or science subject or graduation from an appropriate two year vocational technical instructional program, three years experience at the journeyman level, completion of short training programs at the discretion of the Commissioner of Education; Texas required 7 years experience in the trade; and Vermont required 2 years recent trade experience.

This is just a sampling of the varying attitudes toward the work experience requirement by each of the certifying agencies. They are certainly in agreement on the need for work experience. The disagreement is on the appropriate amount.

In summary, there is agreement that the requirement for valid work experience has been the cornerstone of certification of vocational teachers since the Smith-Hughes Act of 1917. In federally-reimbursed programs such as Chapter 74 in Massachusetts, the law is clear that only persons with practical experience be allowed to teach. However the amount is variable from 3 to 8 years. Massachusetts has one of the higher requirements--6 years--in terms of years of work experience. This experience is carefully evaluated by the Office of Professional Development, Division of Occupational Education and confirmed by vocational competency testing.

Massachusetts Work Experience Requirement

Chapter 74 Regulations relating to instructional personnel including teachers and instructors are clear on the issue of the work experience requirement:

> Provisional approval for a period not to exceed 3 years shall be granted to instructional personnel for vocational programs that meet the folowing requirements; the candidate should have a high school diploma or the equivalent; the candidate shall have and submit documentation of full-time work experience acceptable to the Division of Occupational Education in the occupation in which he/she proposes to teach as follows: the candidates for positions to teach occupations relating to trade and industry shall have a minimum of 6 years of full-time work experience in the occupational area in which she/he proposes to teach provided, however, that a Bachelors degree from an accredited college or university in the occupational area in which he/she proposes to teach may be substituted for 3 years of the 6 years of required work experience and provided further that a Bachelors and a Masters degree from an accredited college or university in the area in which he/she proposes to teach may be substituted for 4 of the 6 years required work experience.

The Division interprets recent full-time work experience to mean that the work experience must have occured within the ten years immediately preceding request for approval. The regulation is being rigidly enforced.

Background of Competency Testing

In 1966 Kazannas and Kieft reported on an experimental project in Michigan to determine more effective vocational teacher certification procedures by means of competency examinations. Their study presented recommendations determined from competency exams that had been in use in other states of the United States. Competency exams for vocational teachers prior to that study were being used to some extent in

California, District of Columbia, Kansas, Massachusetts, Michigan, New York, Pennsylvania, South Carolina, Texas, Wisconsin, although not necessarily for certification. The report included data on which vocational areas were being tested, types of tests used, who was tested, who developed the test, consequences of failing the test, how long the test had been used, whether the test was standardized or validated, when they were revised, and the problems encountered and test preparation and administration. The data were derived from questionnaires mailed to educators across the country. The conclusion of this research was that if competency examinations were put to maximum use that they would be very effective in determining the technical knowledge and skills of teacher candidates, increasing the number of vocational teachers by allowing the elimination of the unrealistic work and academic requirements, and indicating areas of weakness, thus improving the quality of teachers.

Simons in (1977) wrote, "Consequently persons selecting and certifying trade and industrial teachers perceive the need for more effective means of appraising applicants for teaching positions. They feel the decision to employ new teachers should be based on evidence of competency rather than opinion." In other words, many states have recognized that the number of years work experience as shown on paper may or may not neccessarily show the competence of the individual that they are planning to hire. And so, as recorded in Barlow, (1967), "Since 1919 occupational competency tests have been used to some extent to determine the competency of trade and industrial teachers."

As vocational education increased so did the need for the use of occupational competency examinations for the selection and certification of trade and industrial teachers. The increasing use of competency examinations began institution by institution, state by state, but as written by Scott Whitener (1981)[*], "However, examinations developed and authorized by individual institutions or states were not always satisfactory. When all factors were considered, the duplication in manpower time and effort and expenses resulted in a relatively small number of exams lacking quality. Thus, the need for a nationally coordinated program of occupational competency test development became obvious."

Aaron J. Miller in his report to the American Vocational Association Ad Hoc Committee on Professional Development Standards indicated that: "There is a critical need for some mechanism that can be used to certify the occupational and technical competencies of vocational teachers. This is especially true for the non-degree vocational teacher. Variances across states in work experience and inservice teacher education requirements insure that the problem of evaluating work experience persists."

Formation of the National Occupational Competency Testing Institute (NOCTI)

In May of 1971, Gordon McMann of Rutgers University, via a grant from the U.S. Office of Education set up a consortium of states which indicated a desire to participate in a national vocational competency testing project. This consortium is a non-profit educational corporation organized in June 1973 with headquarters originally at Albany, New York and presently at Ferris State University, Michigan.

Currently there are 46 states and the District of Columbia in the consortium of states governed by the Board of Directors. NOCTI was created in an effort to provide a uniform national occupational competency program to serve vocational educators on a permanent basis.

Contribution of the American Institute for Research, (AIR)

As reported in Competency Measurement in Vocational Education, A Review of the State of the Art, American Institute of Research, June 1981, Albert Chapulsky reports on current activities in occupational competency measurement. In October of 1979, the American Institute for Research was awarded a contract from what is now the Office of Vocational and Adult Education of the Department of Education. The purpose of this grant was to develop, field test, and disseminate comprehensive measures of competencies in 14 selected occupational areas and to design and to help implement a program for continuing test development on a self-support basis. AIR competency measures have been developed specifically to help teachers and administrators of secondary and

post-secondary vocational education programs evaluate and improve specific areas of their vocational programs, and to provide an objective basis for informing students' parents and employers of the progress made by students in acquiring specific job-related competencies. The development process and validation studies parallel the work done by NOCTI and the Commonwealth of Massachusetts.

In addition to the 14 vocational competency tests produced by the American Institute for Research, a series of instructional modules called VECS modules were prepared and four of those relate specifically to the development and administration of competency testing. Modules 17-20 in the VECS series are based on work of the American Institute for Research in carrying out the Vocational Competency and Measures Project under contract with the Office of Vocational and Adult Education, U.S. Office of Education. The project was a major effort, begun in October, 1979 continuing through the end of 1982, to provide an actual model for vocational competency test development.

One major difference between the testing offered by NOCTI and that offered by AIR is in the funding. It should be noted that tests are administered only by NOCTI area test centers and are not available for purchase or loan. That is, the state joins a consortium and then reaches an agreement with NOCTI making them eligible to use the corsortium owned materials. In the case of AIR, however, tests are available for purchase by the administering agency.

Other Competency Test Developers

According to Chalupsky, federal funds have supported several other organizations directly concerned with vocational competency testing in recent years and in addition have contributed much money to the test related projects through grant allocations to individual states. The Clearinghouse for Applied Performance Testing, and the National Center for Research of Vocational Education are prime examples.

Background of Massachusetts Approval Process

Massachusetts has had a competency-based vocational educational approval process for 2 1/2 decades. Prior to 1978, prospective vocational teachers took written and practical examinations of varying lengths as a prerequisite to employment. Little or no documentation existed on the content of practical examinations. Reported results contained no verifiable data. Practical exams were administered in only a few locations and results freguently depended upon the observations of a single individual.

As stated in the Resnick and Carmmody study dated January 1977, "The Office of Professional Development within the Division of Occupational Education, Massachusetts State Department of Education was the first established in 1971 under the auspices of former Associate Commissioner Charles H. Buzzell. The purpose of this office was to coordinate the approval of occupational education instructors throughout the Commonwealth as well as to administer the funds awarded to the states for the Education Professional Development Act, Public Law 90-35. Prior

to the establishment of this office, the specific supervisor for each occupational area separately and individually approved instructors for his/her respective fields. To better insure a uniform and more efficient system there was a need for centralizatiion of this function as well as standardization of information concerning approval processes and criteria for approval.This need became apparent as the number of vocational instructors greatly increased due to the expansion of regional vocational technical schools throughout the Commonwealth of Massachusetts."

Formation of the Massachusetts Vocational Competency Testing Program

In 1978, Massachusetts suspended the testing program until the situation could be carefully studied. Four alternatives were considered: discontinue testing completely; fund a program with a vocational school as the local education agency; designate a college as a local education agency; join the National Occupational Competency Testing Institute. The Office of Professional Development, Division of Occupational Education, was made responsible for the administration of the testing program.

Fitchburg State College was awarded funding under a federal grant for the 1979/80 year the program was operated out of the office of Dr. George James. On January 15, 1980, with the hiring of a program coordinator, the Massachusetts Vocational Competency Testing Program began full operation. Work under this grant was specifically directed toward providing a reliable and valid testing program for vocational trade and industrial education teachers. Currently work is underway to update the existing tests in 45 trade areas and to develop new tests as

the need becomes evident.

The written portion of the examination is administered twice a year; the first Saturday of October, and the first Saturday of March. Successful candidates from each of these testing sessions take the practical examination, administered the last Saturday of April.

The written examination consists of from one hundred to one hundred fifty questions, mutiple choice format, and is computer scored. Candidates take the examination that they are approved for by the Office of Professional Development, Division of Occupational Education, after a careful review of the candidate's work experience documentation. The practical examination consists from three to ten tasks to be performed in the actual shop setting. Candidates are given four hours to complete these tasks and are rated independently by two to four examiners. A standardized task analysis format is used for the scoring of these examinations, and a composite score is reported to the Test Review Board which determines the cut-off score for each trade. For a complete discussion of this procedure, see the Manual to Accompany the Massachusetts Vocational Competency Testing Program. Examinations are available in the following areas:

> Agricultural Mechanics, Air Conditioning, Architectural Drafting, Auto Body, Auto Repair, Automotive Machinist, Baking, Boatbuilding, Building Maintenance, Cabinet Making, Carpentry, Clothing, Commercial Art, Copy Preparation, Cosmetology, Data Processing*, Diesel Mechanics, Electro-Mechanical Drafting, Electronic Assembly, Electronics, Machine Drafting, Machine Shop, Major Appliance Repair, Marine Mechanics, Masonry, Media Technology, Metal Fabrication, Offset Preparation, Offset Press, Packaging Technology, Painting and Decorating, Photography, Plant Maintenance, Plastic Technology, Precision Sheet Metal, Radio and TV Repair, Restaurant Management, Sheet Metal, Small Engine Mechanics, Steam Engineering, Upholstery, Welding

Data Processing is offered with a choice of languages. Two languages must be chosen for the written examination, one of which will be the language of choice for the practical examination. Currently available are: BASIC, RPG II, COBOL, FORTRAN, and PASCAL.

How Massachusetts Differs from Other States.

Certification agency. Massachusetts' certification agency is unique among the 50 states. According to Aaron J. Miller, March 1982,

> In 30 states the state board of education controls teacher certification or delegates authority to a state agency which is assisted by an advisory council representing different segments of the teaching profession. There may or may not be a requirement that educators be represented in the agency itself. The agency makes recommendations to the state board concerning certification standards and procedures. The state board, however, has final authority for acceptance, execution, and delegation of certification matters. Sixteen states have a teachers' standards and practices board or commission which is advisory to the state board of education or its education agency. There is a special body where educators are heavily represented in its membership. It has authority to establish critieria for certification standards, issues certificates, institutes disciplinary action, develops teacher education standards and develops reciprocal agreements from other states. Two states have a fully-independent teachers' standards and practices board with legal jurisdication over the preparation of teachers. This type of commission has full and final authority to control certification standards and practices effecting teachers in the state. There are two states with certification agencies unlike those described above. One has a council on teacher education which is responsible for certification standards and practices. In the other (Massachusetts), the Division of Occupational Education, Office of Professional Development, is responsible for certification.

Ten Approval Factors. The criteria mentioned in the General Laws, Chapter 74,S.1, are commonly referred to as the "Ten Approval Factors." These approval factors are as follows: "organization, control, location, equipment, course of study, qualifications of

teachers, methods of instruction, conditions of admission, and employment of pupils, and expenditures." These form the cornerstone of regulations relating to vocational education in the State of Massachusetts. This dissertation is primarily concerned with the approval factor having to do with qualifications of teachers.

Other Studies Concerning the Work Experience Requirement for Certification

Nine studies have been selected for presentation here because they relate directly to the correlation of occupational experience and occupational competency. These studies have been arranged in chronological order starting with the oldest study--that of George Storm, Oregon State University, 1966.

The study entitled "Preparation of the Successful Teacher," by George Storm concerns successful teachers in technical education. The purpose of this study was to assist in the development of approved technical education teacher programs. Specifically the project sought to determine the many factors in the background of successful technical teachers that may have accounted for their success in teaching. One of the eight questions asked in this study was what was the nature of the successful technical teacher's industrial experience. The questionnaire sent out for this study was categorized in two parts. The top 22 percent constituted the high success group and the botton 22 percent served as the low success group.In the

question relating to industrial experience, the average low success instructor had 4.1 years more industrial experience than the high success teacher who had more advanced degrees in education. The average low success instructor had 1.2 years more teaching experience than the high success teacher.

William Grenville Ellis, Pennsylvania State University, 1968[*], studied the "Relationship of Related Work Experience to the Teaching Success of Beginning Business Teachers." The purpose of this study was to determine what relationship, if any, related work experience had to the teaching success of beginning business teachers in secondary schools based on supervisor ratings. student ratings, and personal ratings by teachers. Business teachers with related work experience were given significantly higher, ratings by their immediate supervisors than were the business teachers without the related work experience. Ratings assigned by the supervisor and students to the business teacher with more than one year related work experience were not found significantly greater than the rating assigned to the business teachers with one year or less of related work experience. In general, the conclusions of this study were that related work experience does appear to have positive relationship to the teaching success of beginning business teachers. This conclusion is supported by the evidence gathered during the interviews with the supervisors and business teachers but not supported by student ratings.

A study by Lloyd Frederick Spaulding, North Carolina State University, (1971), entitled, "A Study of the Relationship between

Selected Characteristics of Shop and Laboratory Instructors and Student Achievement in Vocational and Technical Educatiion," related to student achievement rather than occupational competence. One item in the conclusion of this study is of interest. "The item of length of field experience was statistically sterile but the inference which can be drawn should effect the future thinking of policy makers all over this nation as they study ways and means of attracting qualified people into vocational or technical teaching out of industry itself."

This study showed that it was not particularly important for an instructor candidate to have been in industry for any specified time. According to this study, to continue to use such a requirement as a criterion measure of a potentially good instructor was questionnable. Some other qualifying policy might be sought so that potentially fine instructors are not prevented from becoming teachers by such an unrealistic requirement.

A study by LLoyd Demare Brooks, University of Tennessee, (1971), entitled, "Relationship Between Related Work Experience and Teaching Effectiveness of Vocational Office Education Teachers," also related to teaching effectiveness rather than vocational competency. But the conclusions are interesting. There were no significant differences in teaching effectiveness of vocational office education teachers categorized according to the number of years of related work experience, number of jobs performed, or number of job tasks performed. Although the assumption was not supported, this study reported that a majority, (98 percent), of vocational office education

teachers agreed with the viewpoint expressed in the professional literature that work experience contributes to teaching effectiveness.

The next study, by Edward Milan, Colorado State University, (1972), is entitled "Comparison of Colorado Trade and Industrial Teachers." The main purpose of this study was to determine what were the differences in performance of vocationally credentialed trade and industrial education teachers with different formal education backgrounds. The determination was made by comparing teachers with Baccalaureate degrees or higher in vocational education, teachers with Baccalaureate degrees or higher in a discipline other than vocational education, and teachers with less than Baccalaureate degrees. A secondary purpose was to determine the strength of the relationship of some of the characteristics which were common to the three groups. One of the objectives of this study was to evaluate the appropriateness of occupational experience. The findings were as follows: the occupational experience above the amount required for credentialing is not as highly significant as other variables and professional teaching experience is more of a significant variable than the occupational experience variable.

The next study to be reviewed is by James William Covey, University of Wisconsin, (1973), entitled, "The Testing of Four Major Dimensions of Professional Preparation Models for the Development of Vocational Technical Educators." The purpose of this study was to assist in solving the problem of preparing an adequate number of vocational teachers to meet the demands of vocational education. It

was a judgemental study based on opinion survey of selected vocational educators. The population consisted of educators from the following: (1) teacher educators; (2) administrators; (3) vocational teachers. The survey instrument assessed the respondent's attitudes towards the teacher preparation process as it relates to, among other things, occupational preparation, general education, technical education, and professional education. Relating to the issue of this study, the Covey study determined the following: that the respondents strongly supported the concept that occupational experience was important in the preparation of vocational educators. Respondents to this study favored requirements of 3-5 years for trade and industry teachers. When teacher educators and teachers themselves were asked an opinion, they strongly supported the concept of occupational background as a precursor of occupational competency and teacher preparation.

A study by Merwin Allan Klehm, Ohio State University, (1974), was entitled " The Status of the Certification Requirements for Trade and Industrial Teachers in the United States." The purpose of this study was to investigate the status of current practices in maintaining a supply of trade and industrial education teachers, to ascertain trade and industrial teacher certification practices and requirements, and finally, to learn of the procedures for obtaining permanent certification of trade and industrial teachers. The population included the state administrator of trade and industrial education in each of the states in the United States. Among the findings of this study was the fact that achieving occupational

competency through work experience remained the basic requirement for certification among the state administrators. Without allowances for other qualifications, the mean years of occupational experience required ranges from 4.3 to 4.7 years. The mean number of years allowed towards work experience for successful passage of an occupational competency test was one year. The mean number of years allowed toward occupational experience for successful completion of four-year apprenticeship program varied from 3.1 for the secondary level to 3.4 for post-secondary. Allowance for private trade school instruction toward occupational experience amounted to 1.3 for secondary and 1.5 for post-secondary. Possession of a Baccalaureate degree in vocational education provided allowance towards occupational experience of 3.1 years for secondary and 3 years for post-secondary. Among the conclusions, regardless of the various allowances toward occupational experience, the data showed that states did not certify an individual without some work expeerience in a chosen field.

A study by Frederick G. Welch and C. William Garner published in the American Vocational Journal, (1976), was entitled, "Occupational Experience--How Much is Enough is Enough?" This study sought to compare two rather diverse populations. The populations were the older persons with more years of work experience and who were deemed competent in an occupation, recruited into the profession, and through an inservice program were provided with necessary teaching methodology. After 60 hours of post-secondary work, they became permanently certified. The second population were those who graduated

in a Baccalaureate program. Students were recruited from vocational technical schools or apprenticeship programs. Meeting the degree requirements, they must have completed a learning period in their occupational specialty as well as perform satisfactorily for two years as a journeyman through supervised on-the-job training. A number of comparisons were possible between these two populations. One study undertaken to make these comparisons found that at the time they began their studies, certificate students and certificate teachers averaged 14.35 years work experience while the Baccalaureate students and graduates began their college studies with an average of 5 years of work experience. Little difference was found between the two groups on occupational competency examination scores. Virtually all participants had taken the exam whle still practicing their trades. The first conclusion of this study was that the primary emphasis must be placed on the program that offers adequate preparation for entrance into the classroom. The Baccalaureate degree program had been shown to be superior in this regard. Second, work experience should be given a realistic rather than an idealistic status as a prerequisite for both the certificate and Baccalaureate programs. While excessive work experience in occupational areas may not be detrimental, neither does it indicate superiority. Finally, a process for determining occupational proficiency must be established whereby a skilled craftsman is recognized.

The next study is by Gary Moore published in Journal of Vocational Education Research, Winter (1976), and entitled "Teaching

Effectiveness of Industry Level Teachers in Vocational Agricultural from College Versus Industry." This study attempted to develop a method of assessing the effectiveness of vocational agriculture teachers and to use this method to compare teachers coming from college and those from industry. Teacher performance tests and teacher educator evaluations and student evaluations were used to make the comparisons. Conclusions generally stated that four-year povisionally certified teachers were more effective than those who were one-year vocationally certified. There were significant differences in teacher behaviors and many of these behaviors correlated highly with teacher effectiveness. Low correlation between student ratings of teachers and other measures of teaching effectiveness were consistent with other research findings. Student ratings did not appear to be reliable evaluation tools.

The research reported here seems to fly in the face of reason. Logically and intuitively the assumption is the more experience a person has, the more occupationally competent the person would be, and by extension, the better teacher s/he would be. However, research trying to link the number of years of work experience and occupational competency is inconclusive. There has been no clear investigation of the effect of work experience in combination with teaching experience and educational background. It is to this combination that this research is addressed.

CHAPTER III

METHODOLOGY

The purpose of this study was to determine whether or not there was a relationship between the number of years of work experience, teaching experience and educational background and scores on the Massachusetts Vocational Competency examinations.

Research Questions

The research questions to be examined by this study are the following:

1. Is there a relationship between work experience and occupational competence as measured by the Massachusetts Vocational Competency examinations?

2. Is there a relationship between educational background and occupational competence as measured by the Massachusetts Vocational Competency Examinations?

3. Is there a relationship between teaching experience and occupational competence as measured by the Massachusetts Vocational Competency Examinations?

4. Is occupational competence determined by all three factors? That is, can occupational competence be determined by an examination of work experience, educational background, and teaching experience?

Population

The population from which the sample for this study was selected consisted of all the candidates for Vocational Teacher Approval in the Commonwealth of Massachusetts, from the Spring of 1981 through the Spring of 1984. The population was composed of approximately 2000 candiates and involved 45 different occupational areas. See Table 1 for the distribution of the number of candidates eligible to take the examinations, the number registered, and the number actually completing the process.

TABLE 1
DESCRIPTION OF THE POPULATION

YEAR	EXAM	ELIGIBLE	REGISTERED	FAIL	PASS	TOTAL
1981	WRITTEN	705	428	101	324	425
1981	PRACTICAL	445	421	144	262	406
1982	WRITTEN	432	308	100	194	294
1982	PRACTICAL	259	255	64	189	253
1983	WRITTEN	474	297	100	192	292
1983	PRACTICAL	269	240	91	147	238
1984	WRITTEN	426	301	109	197	306
1984	PRACTICAL	315	247	67	171	238
TOTAL	WRITTEN	2037	1334	410	907	1317
	PRACTICAL	1288	1163	355	769	1124

The number of candidates eligible to take the examinations in the year 1981 reflected the number of candidates held over from the three years previous to 1981. The Division of Occupational Education declared a moratorium on testing during those years, while the present program was conceived and funded.

Sample/Regression Analysis

A random sample of five hundred candidates was taken across all four years. This sample was taken from the total number of candidates having taken the written examination, regardless of trade classifications. Then each candidate's score was matched with his/her practical score by means of the Social Security number. A total of 403 matches were made. Therefore, the sample for the regression analysis was 403 candidates.

Each score in this sample then had to be classified as a pass or fail. The average passing score was found for each year. Table 2 summarizes these passing scores.

TABLE 2
AVERAGE PASSING SCORES BY YEAR

YEAR	PASSING SCORE	
	WRITTEN TEST	PRACTICAL TEST
1981	60%	68%
1982	64%	69%
1983	65%	69%
1984	66.9%	69.5%

Sample/Trade by Trade Analysis

The Massachusetts Vocational Competency Testing Program has examinations in 45 occupational areas. Seven occupations were chosen for this study. They were auto mechanics [AM], carpentry [CP],

culinary arts [CU], electricity [EL], electronics [EO], machine shop [MS], and metal trades [MT]. These occupations were chosen for this study because they met one or more of the following criteria:

1.Trades in which a teacher shortage existed at the time of the study. Teacher shortage for a trade is defined as a trade in which more than 50 percent of the people examined are on waiver.(See Final Report for the years 1981, 1982, 1983, and 1984 for a chart showing these figures.)

2.Trades which have the largest number of candidates.

3.Licensed trades.

Each of these examination areas have two separate components: a written examination and a practical examination. The written examinations were conducted at one site at one time for approximately 200 candidates. In 1983, a Fall administration of the written test was added to the testing schedule. The scores from this administration were considered part of the 1984 figures. The practical examinations were administered at 16 different regional vocational schools throughout the state on the same day.

Sample composition

A description of the sample by trade follows in Tables 3 and 4. Data on the practical examination in Culinary Arts was not available for the year 1981.

TABLE 3
DESCRIPTION OF SAMPLE/WRITTEN

YEAR	AR	CP	CU	EL	EO	MS	MT
1981	38	38	20	20	32	30	17
1982	30	21	19	17	20	22	10
1983	27	33	17	23	27	24	10
1984	39	18	32	13	33	23	15
TOTAL	134	110	88	73	112	99	52

TABLE 4
DESCRIPTION OF SAMPLE/PRACTICAL

YEAR	AR	CP	CU	EL	EO	MS	MT
1981	41	46	N/A	21	28	31	11
1982	16	28	14	14	14	22	8
1983	17	32	13	23	22	21	10
1984	29	21	26	12	25	15	12
TOTAL	103	127	53	70	89	89	41

Passing scores in percentages

Each score was classified as a pass or a fail. The actual passing score for each year for each trade was used. These percentage scores are summarized in Table 5 for the written examination.

TABLE 5
PASSING SCORES/WRITTEN EXAM(%)

YEAR	AR	CP	CU	EL	EO	MS	MT
1981	50	66	N/A	63	52	53	62
1982	60	68	68	62	45	64	67
1983	65	69	60	65	50	70	65
1984	65	70	65	70	55	70	67

The actual passing scores on the practical examination for each year of the study are given in percentages and summarized in Table 6.

TABLE 6
PASSING SCORES/PRACTICAL EXAM(%)

YEAR	AR	CP	CU	EL	EO	MS	MT
1981	70	70	NA	70	70	70	70
1982	70	65	70	70	70	60	70
1983	65	65	70	70	70	65	69
1984	65	67	70	70	70	68	70

Variables

The dependent variables involved in this study were the written and practical examination scores. The independent variables were the number of years of occupational experience, number of years of teaching experience, and educational level of the candidate.

Definitions of independent variables

Occupational experience. Occupational experience was defined as the number of years of work experience in a specific trade area that the candidate had at the time of the administration of the Massachusetts Vocational Competency examination.

Teaching experience. Teaching experience was defined to be the number of years teaching at a level described in the survey questionaire that a candidate had at the time of administration of the Massachusetts Vocational Competency examination.

Educational level. Educational level was defined to be the length of time in programs as described in the survey that the candidate had at the time of the administration of the test.

Definition of dependent variables

Scores on the written and practical examinations. Percentage scores were classified as either a pass or fail.The Test Review Board set the passing score by trade immediately after each administration of the examination.The policy of the Board was to set the passing score at seventy or below as circumstances warrant. A complete discussion of this policy is found in the Manual to Accompany the Massachusetts Vocational Competency Testing Program.

Collection of data

The source of data for this study was the questionnaire administered at the time of the written exam. This questionnaire was given to each candidate participating in the Spring 1981, Spring 1982, The Spring and Fall of 1983, and Spring of 1984 testing programs. This information was processed at the same time as the candidate's test was corrected.

Questionnaire description

The questionnaire consisted of 15 questions. The questions which formed the basis for this study were grouped into three categories:

a) work experience, b) teaching experience, and c) educational background. The set of ten questions were grouped as follows:a) one question related to amounts of work experience, b) five questions related to teaching experience, and c) four questions related to educational background. (See Appendix A for the text of the "Background Information Questionaire")

Work Experience. The one question relative to work experience asked the candidate to indicate the total number of years s/he had worked in the trade area of the test. There were five possible responses to this question. They are: a) Less than six years of experience; b) six to twelve years of experience, c) thirteen to eighteen years of experience,d) nineteen to twenty-four years of experience, and e) more than twenty-four years of experience.

It should be noted that Massachusetts Department of Education requirements for approval of vocational teachers mandates six years of experience for all candidates for vocational teacher approval. Exceptions occur only when a candidate has one or more degrees in the trade area of the test. Therefore, there were relatively few candidates in the first category.

Teaching Experience.The five questions relating to teaching experience were as follows:

Question one asked the candidate to indicate the total number of years of teaching experience s/he has had in any area, at any level.

Question two asked the candidate to indicate the number of years of secondary level teaching experience s/he has had in any area at the secondary level.

Question three asked the candidate to indicate the number of years experience teaching vocational, technical, occupational, business or industrial arts courses s/he has had at the secondary level.

Question four asked the candidate to indicate the number of years of experience s/he has had teaching vocational courses in the trade area of the test at the secondary level

Question five asked the candidate to indicate the number of years of experience s/he has had teaching vocational courses in the trade area of the test at OTHER than the secondary level: i.e. adult evening couses, military, etc.

The candidate was asked to respond to all questions relative to teaching experience using the following categories:

1) No experience
2) Less that one year
3) One to three years
4) Four to six years
5) More than six years

Educational Background. The third group of questions asked the candidate to indicate his/her educational background with a series of four questions. Each of these questions had different responses, as follows:

Question one asked the candidate to indicate how much formal training in addition to high school courses in nondegree programs s/he

had.(i.e. apprenticeship, on the job training, professional training institutes, etc.)

Responses were:

1) No training beyond high school
2) Less than three months
3) Three to six months
4) Seven to twelve months
5) More than one year

Question two asked the candidate to indicate how many years of formal education had been completed in a diploma granting institution.

Responses were:

1) Some high school (Less than 12 years.)
2) Completed high school (12 years)
3) Associates degree (13-14 years)
4) Bachelor's degree (16 years)
5) Graduate work (More than 16 years)

Question three asked the candidate to indicate how many undergraduate credits s/he had in all vocational education cousework.

Responses were:

1) No credits
2) Less than six credits
3) Six to twelve credits
4) Thirteen to twenty-one credits
5) More than twenty-one credits

Question four asked the candidate to indicate the number of undergraduate credits s/he had in vocational education coursework specific to the trade area of the test.

Responses were:

1) No credits
2) Less than six credits
3) Six to twelve credits
4) Thirteen to twenty-one credits
5) More that twenty-one credits

Additional questions. Additional questions on the Demographic Survey are reported in an effort to draw a profile of the average candidate. These questions relate to the candidate's employment status at the time of the test, if the candidate was licensed in his/her trade at the time of the test, if the candidate had been a member of the military, and if the candidate had been teaching under a Temporary Conditional Approval status at the time of the test. (Temporary Conditional Approval is granted to the school system by the Division of Occupational Education, Department of Education upon request by the hiring superintendent provided that s/he can prove that no previously approved candidates are available for employment.)

Instrumentation

Test Reliability. The reliability coefficient, a measure of consistency, was calculated for each test. The Spearman-Brown split half method was used, where the odd numbered questions constituted one half, and the even numbered questions constituted the other half. The results of this calculation are shown in Table 7.

TABLE 7
TABLE OF RELIABILITIES

TRADE	RELIABILITY
AUTO REPAIR	.89
CARPENTRY	.92
CULINARY ARTS	.88
ELECTRICAL	.88
ELCTRONICS	.93
MACHINE SHOP	.93
METAL TRADES	.92

Test validity. The content validity of the Massachusetts Vocational Competency Examinations was achieved by means of the test development process, described in detail in the Manual to Accompany the Massachusetts Vocational Competency Testing Program.

Treatment of data

Regression analysis. Mutiple regression is a general statistical technique through which one can analyze the relationship between a dependent variable and a set of independent variables. The first use of the technique as a descriptive tool in this research was to control for other factors in order to evaluate the contribution of a specific variable. In this way, the teaching experience most influential on written or practical examination scores was identified. The same technique was used to identify the educational experience which had the most influence on test scores. Mutiple regression may also be viewed as a descriptive tool by which the linear dependence of one variable on others is summarized. The second use of this technique in this study was to find the best linear prediction line and evaluate its prediction accuracy. In this way, the interaction of work experience, teaching experience, and educational background on test scores was shown in a set of two equations. One equation dealt with written test scores, and the other had to do with practical test scores.

Beta Values. A partial regression coefficient stands for the expected change in the dependent variable with a change of one unit in the independent variable. When more than one independent variable is involved, each Beta value represents the expected change in the dependent variable (test scores) with a change of one unit in the independent variable (work experience, for example), while the other variables are being held constant or otherwise controlled. The total correlation or relationship may be decomposed into a sum of a number of terms, each of which is a product of a beta value and another correlation, that may be decomposed again. (For a complete discussion of this technique, see Social Statistics, Hubert Blalock, jr, 1960, pgs 479-487)

Test of independence. The next step in this analysis was to apply the Chi-square test. The Chi-square as a test of statistical independence, helped to determine whether a systematic relationship existed between two variables. This was done by computing the cell frequencies which would be expected if no relationship existed. These expected frequencies are then compared to the actual frequencies observed. The greater the discrepancies between the expected and actual frequencies, the larger the Chi-square becomes. Small values of Chi-square were interpreted to mean the absence of a relationship, or statistical independence. A large value of Chi-square indicated a systematic relationship existed between the variables. By itself, Chi-square helped us to decide whether or not the variables are independent or related. Strictly speaking, the Chi-square does not

indicate the degree of the relationship. Part of the reason for this was that Chi-square calculations were dependent upon the size of the sample and the number of rows and columns in the cross-tabulation table. When Chi-square was adjusted for these factors, it became the basis for assessing strength of relationship.

Pearson correlation coefficient. The Pearson correlation coefficient was generated to assess the strength of the relationship between the written examination scores and the practical examination scores. A value near zero indicates little or no relationship, while a value approaching one indictes a strong relationship. This relationship can be either positive or negative.

CHAPTER IV

FINDINGS

Findings Relative to the Written Examination

Teaching Experience

Regression analysis was performed on the responses to the five questions about teaching experience to determine the one question which had the largest positive influence on written test scores. Table 8 shows the results of this analysis. The largest positive Beta value was obtained for the responses to question three. The result was statistically significant at the .01 level. The conclusion was that the number of years of experience teaching vocational, technical, occupational, business or industrial arts courses at the secondary level was the factor most related to written test scores.

TABLE 8
EFFECT ON WRITTEN TEST SCORES OF TEACHING EXPERIENCE

QUESTION	BETA VALUE	F-RATIO	SIGNIFICANCE
T3	1.89	6.30	.01
T5	.341	.344	.6
T1	-.062	.006	.9
T2	1.07	1.87	.2
T4	-1.74	4.91	.02

Educational Background

Regression analysis was performed on the responses to the four questions about educational background to determine the one experience which was the most influential on written test scores.Question two had the largest positive Beta value. Therefore, the conclusion was that the number of years of formal education was the most influential factor on written test scores. This finding was significant at the .05 level. Table 9 shows the results of this analysis.

TABLE 9
EFFECT ON WRITTEN TEST SCORES OF EDUCATIONAL EXPERIENCE

QUESTION	BETA VALUE	F-RATIO	SIGNIFICANCE
E2	1.20	3.88	.05
E4	.234	.168	.7
E1	.201	.260	.6
E3	-.442	.611	.4

Work experience

Since there was only one question relative to work experience, this question was included in all statistical analyses throughout the study. The effects of the linear regression on the responses to this question are shown in Table 10.

TABLE 10
EFFECTS ON WRITTEN TEST SCORES OF WORK EXPERIENCE

QUESTION	BETA VALUE	F-RATIO	SIGNIFICANCE
W1	-.525	.822	.4

Interaction of three variables

Table 11 shows the results of the interaction of the three independent variables and their effect on the dependent variable, written exam scores, derived from a regression analysis using the one variable chosen from each group described above.

TABLE 11
INTERACTION OF THREE VARIABLES

VARIABLE	STEP	BETA	F-RATIO	SIGNIFICANCE
W1	1	-.470	.724	.4
T3	2	.157	.110	.7
E2	3	.995	2.97	.07

Since W1 was the only question dealing with work experience, this was included in the final equation. With a Beta value of -.5, the indication was that as the number of years of work experience increased, written test scores decreased slightly. This finding was not statistically significant.

Of the five questions dealing with teaching experience, there were two questions with Beta values which were statistically significant. Question T4 was significant at the .02 level, and question T3 was significant at the .01 level. T3 was chosen because the Beta value was the largest positive Beta value obtained. Question T4, significant at the .02 level, had a negative Beta value, and was contrary to the purpose of this study, which was to identify those characteristics which have a positive influence on test scores.

Of the four questions dealing with educational background, E2 was chosen because it had the largest positive Beta value of the four reported. This value was significant at the .05 level. When entered into the regression equation, the indication is that as work experience increases, written exam scores decrease slightly. This finding was not statistically significant. As the years of teaching vocational, technical, occupational, business or industrial arts courses increases, written exam scores increase slightly. Finally, as years of formal education increase, so do written exam scores. In terms of Beta coefficients, the equation showing the interrelationship of education, teaching experience, and work experience is as follows:

Score=.99E + .16T + -.47W +67.3.

In simpler terms this can be expressed as follows: the written exam score is mathematically related to sixty percent education, ten percent teaching experience, and thirty percent work experience.

Test of independence

The next step in this analysis was to apply the Chi-square test. The Chi-square was a test of statistical independence. It helped to determine whether a systematic relationship existed between two variables. This was done by computing the cell frequencies which would be expected if no relationship existed. These expected frequencies were then compared to the actual frequencies observed. The greater the discrepancies between the expected and actual frequencies, the larger the Chi-square becomes. Small values of Chi-square were interpreted to mean the absence of a relationship, or statistical independence.

A large value of Chi-square indicated a systematic relationship existing between the variables. By itself, Chi-square helped to decide whether or not the variables were independent or related. Strictly speaking, the Chi-square did not indicate the degree of the relationship. Part of the reason for this was that Chi-square calculations were dependent upon the size of the sample and the number of rows and columns in the cross-tabulation table. When Chi-square was adjusted for these factors, it became the basis for assessing strength of relationship. For the purposes of this study, the Chi-square test was applied to determine whether passing the written examination was independent of work experience, teaching experience, and educational background.

Work experience. Table 12 shows the observed frequencies for those candidates passing and failing the written test as related to responses to the question on work experience.

TABLE 12
RELATIONSHIP OF WORK EXPERIENCE TO PASS/FAIL WRITTEN EXAM

CNT. RPCT CPCT	≤6YRS	6-12YRS	13-18YRS	19-24YRS	≥24YRS	TOTAL
PASS	5	95	53	27	27	207
	2.4	45.9	25.6	13.0	13.0	51.4
	50.0	49.5	53.0	52.0	54.0	
FAIL	5	97	47	24	23	196
	2.6	49.5	24.0	12.2	11.7	48.6
	50.0	50.5	47.0	47.1	46.0	
TOTAL	10	192	100	51	50	403
PCT	2.5	47.6	24.8	12.7	12.4	100.0

Chi-square=.57749 degrees of freedom =4 p=.9

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level. Examination of these results indicated that pass/fail scores on the written test and years of work experience were statistically independent.

Teaching experience. Table 13 shows the observed frequencies of those candidates passing and failing the written test and their responses to the question on the number of years of teaching vocational, technical, occupational, business or industrial arts courses at the secondary level in either public or private schools.

TABLE 13
RELATIONSHIP OF TEACHING EXPERIENCE TO PASS/FAIL ON WRITTEN TEST

CNT / R PCT / C PCT	NONE	≤1YR	1-3YRS	4-6YRS	≥6YRS	TOTAL
PASS	87	69	19	13	16	204
	42.6	33.8	9.3	6.4	7.8	51.0
	50.3	57.0	32.2	56.5	66.7	
FAIL	86	52	40	10	8	196
	43.9	26.5	20.4	5.1	4.1	49.0
	49.7	43.0	67.8	43.5	33.3	
TOTAL	173	121	59	23	24	400
PCT	43.2	30.3	14.8	5.7	6.0	100.0
	chi-square=12.7		degrees of freedom=4			p=.01

When the Chi-square test was applied, the value obtained was larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, this result was statistically significant at the .01 level. This test indicates that passing or failing the written test is not independent of teaching experiences described above.

Educational background. Table 14 shows the observed frequencies for those candidates passing and failing the written test as related to responses to the number of years of formal education the candidate has completed.

TABLE 14
RELATIONSHIP OF EDUCATIONAL BACKGROUND TO PASS/FAIL WRITTEN EXAM

CNT / R PCT / C PCT	≤11YRS	12YRS	13-14YRS	16YRS	≥16YRS	TOTAL
PASS	7	67	77	29	27	207
	3.4	32.4	37.2	14.0	13.0	51.5
	58.3	41.6	56.6	56.9	64.3	
FAIL	5	94	59	22	15	195
	2.6	48.2	30.3	11.3	7.7	48.5
	41.7	58.4	43.4	43.1	35.7	
TOTAL	12	161	136	51	42	402
PCT	3.0	40.0	33.8	12.7	10.4	100.0
Chi-square=11.28484		degrees of freedom=4				p=.02

When the chi-square test was applied, the result obtained was larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the result was statistically significant at the .02 level. Examination of these results indicated that passing or failing the written section of the Massachusetts Vocational Competency examination was not independent of the number of years of formal education that the candidate has had.

Summary. Table 15 summarizes these findings in order of strength of relationship. The number of years teaching occupational, business, vocational or industrial arts courses at the secondary level has the most effect on written scores on the Massachusetts Vocational

Competency examination. The next most influential factor, and very close to the first, was the number of years of formal education. Work experience has a very weak relationship to test scores.

TABLE 15
SUMMARY OF CHI-SQUARE VALUES

QUESTION	CHI-SQUARE	SIGNIFICANCE
T3	12.8	.02
E2	11.3	.01
W1	.58	.9
critical value of Chi-square=9.48		degrees of freedom=4

Findings Relative to the Practical Examination

Teaching experience

Regression analysis was performed on the responses to the five questions about teaching experience to determine which question had the largest positive effect on practical exam scores. Table 16 shows the results of this analysis. Question T4 had the largest positive Beta value. The conclusion was that of all the teaching experiences described in the Demographic Survey, the number of years teaching vocational courses in the trade area of the test at the secondary level in either public or private schools has the largest positive influence on practical test scores. This finding was not statistically significant at the .05 level.

TABLE 16
EFFECT ON PRACTICAL EXAM SCORES OF TEACHING EXPERIENCE

QUESTION	BETA VALUE	F-RATIO	SIGNIFICANCE
T4	2.01	2.22	.1
T1	1.84	1.97	.2
T3	.175	.018	.9
T5	-1.06	1.13	.3
T2	-3.33	6.19	.01

Educational Background

Regression analysis was performed on the responses to the four questions about educational background to determine which educational experience described on the Demographic Questionaire had the largest positive influence on the practical exam score. Table 17 shows the results of this analysis. The conclusion from this analysis was that the number of months of formal training, beyond the high level that the candidate has had in nondegree programs such as on-the-job training, apprenticeships, professional training institutes had the largest positive influence on practical exam scores. This finding was significant at the .05 level.

TABLE 17
EFFECT ON PRACTICAL TEST SCORES OF EDUCATIONAL EXPERIENCE

QUESTION	BETA VALUE	F-RATIO	SIGNIFICANCE
E1	1.6	5.71	.02
E2	1.10	1.11	.3
E4	.058	.003	.95
E3	-.556	.328	.6

Work Experience

Since there was only one question about work experience, this question was included in all analysis. The effects of work experience on practical test scores is shown on Table 18. The conclusion from this analysis was that the practical test score decreased slightly as the number of years of work experience increased. This finding was not statistically significant.

TABLE 18
EFFECT ON PRACTICAL TEST SCORES OF THE YEARS OF WORK EXPERIENCE

QUESTION	BETA VALUE	F-RATIO	SIGNIFICANCE
W1	-.718	.523	.5

Interaction of three variables

Regression analysis. Table 19 shows the interaction of the three independent variables and their effect on the dependent variable, practical exam scores, derived from a regresion analysis using one variable from each group as previously indicated.

TABLE 19
INTERACTION OF THREE INDEPENDENT VARIABLES

VARIABLE	STEP	BETA	F-RATIO	SIGNIFICANCE
W1	1	-.769	.653	.4
T4	2	.450	.207	.7
E1	3	1.33	4.03	.05

Since W1 was the only question dealing with the number of years of work experience, this was included in the final equation. With a Beta value of -.8, the indication was that as the number of years of

work experience increase, scores on the practical exam decrease slightly. This finding was not statistically significant. Of the five questions dealing with teaching experience, the number of years of teaching vocational courses in the trade area of the test had a slight positive effect on practical exam scores. This finding was not statistically significant. Of the four questions dealing with educational background, the amount of formal training beyond high school in nondegree programs had a substantial positive influence on practical exam scores. This finding was statistically significant at the .05 level.

In terms of the Beta coefficients, the equation showing the effect of education, teaching experience, and work experience on practical exam scores is as follows:

$$\text{Score}=1.3E + .5T + -.8W + 63.8$$

This can be expressed in more understandable terms. The practical exam score is associated with fifty percent education, twenty percent teaching experience, and thirty percent work experience.

Test of Independence

The next step in this analysis was to apply the Chi-square test of independence. This test was used to determine whether or not a relationship exists between the three independent variables and the dependent variable, practical exam scores. Table 20 shows the observed frequencies for those candidates passing and failing the practical test as compared to their responses to the question on the number of years of work experience.

TABLE 20
RELATIONSHIP OF WORK EXPERIENCE TO PASS/FAIL ON PRACTICAL EXAM

CNT. / R PCT / C PCT	6YRS	6-12YRS	13-18YRS	19-24	24YRS	TOTAL
PASS	5	100	56	34	20	215
	2.3	46.5	26.0	15.8	9.3	53.3
	50.0	52.1	56.0	66.7	40.0	
FAIL	5	92	44	17	30	188
	2.7	48.9	23.4	9.0	16.0	46.7
	50.0	47.9	44.0	33.3	60.0	
TOTAL	10	192	100	51	50	403
PCT	2.5	47.6	24.8	12.7	12.4	100.0

Chi-square = 7.66547 degrees of freedom=4 p=.1046

Examination of the results of this analysis revealed that work experience and scores on the practical exam were statistically independent.

Table 21 shows the observed frequencies of those candidates passing and failing the practical exam and their responses to the question on teaching vocational courses in the trade area of the test at the secondary level.

TABLE 21
RELATIONSHIP OF TEACHING EXPERIENCE TO PASS/FAIL PRACTICAL TEST

CNT R PCT C PCT	NONE	≤1YR	1-3YRS	4-6YRS	≥6YRS	TOTAL
PASS	95	72	33	9	5	214
	44.4	33.6	15.4	4.2	2.3	53.2
	48.7	60.5	51.6	52.9	71.4	
FAIL	100	47	31	8	2	188
	53.2	25.0	16.5	4.3	1.1	46.8
	51.3	39.5	48.4	47.1	28.6	
TOTAL	195	119	64	17	7	402
PCT	48.5	29.6	15.9	4.2	1.7	100.0
Chi-square=5.12720			degrees of freedom=4			p=.3

When the Chi-square test was applied, the value obtained did not exceed the critical value (9.48) for a table with four degrees of freedom. The results, therefore, are not statistically significant at the .05 level. Examination of these results shows that teaching experience and scores on the practical examination are statistically independent.

Table 22 show the observed frequencies of those persons passing and failing the practical exam and the number of years of formal training s/he had in nondegree programs

TABLE 22
RELATIONSHIP OF EDUCATIONAL BACKGROUND TO PASS/FAIL PRACTICAL EXAM

CNT R PCT C PCT	≤11YRS	12YRS	13-14YRS	16YRS	≥16YRS	TOTAL
PASS	20	12	30	24	125	211
	9.5	5.7	14.2	11.4	59.2	53.3
	43.5	41.4	56.6	47.1	57.6	53.3
FAIL	26	17	23	27	92	185
	14.1	9.2	12.4	14.6	49.7	46.7
	56.5	58.6	43.4	52.9	42.4	
TOTAL	46	29	53	51	217	396
PCT	11.6	7.3	13.4	12.9	54.8	100.0

Chi-square=6.08 degrees of freedom=4 p=.2

When the chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. The results were, therefore, not statistically significant at the .05 level. One can conclude that scores on the practical examination and educational background as defined in this section were independent.

Summary. Table 23 summarizes these findings in order of strength of relationship. The most influential factor on test scores was the number of years of work experience had by the candidate. The number of months of nondegree training beyond high school was the next, and finally, the number of years of experience teaching vocational courses at the high school level. None of these values was statistically significant at the .05 level. Therefore, one can conclude that the practical examination scores were independent of work experience,

teaching experience, and educational background as defined in this section.

TABLE 23
SUMMARY OF CHI-SQUARE VALUES OBTAINED FROM PRACTICAL TEST DATA

QUESTION	CHI-SQUARE	SIGNIFICANCE
W1	7.7	.1
E1	6.1	.2
T4	5.1	.3
critical value of Chi-square=9.48		degrees of freedom=4

Findings Relative to Both Examinations

Correlation of Written and Practical Examinations

The Pearson Correlation coefficient was generated to examine the relationship between the written and practical examination scores. The value obtained was 0.1 which indicates a weak, positive relationship. Although this value was positive, indicating that as the written score increases, the practical score also increases, the value was so small as to indicate a lack of relationship. This finding was statistically significant at the .05 level.

C H A P T E R V

FINDINGS RELATIVE TO SELECTED TRADES

Trade by Trade Analysis

The purpose of the next phase of this study was to determine the nature of the relationship between scores on the Massachusetts Vocational Competency Examinations and the independent variables previously identified .

1) The number of years of work experience

2) The number of years of teaching experience.

3) The educational background of the candidate.

The responses used in the analysis presented in this section were those which were determined previously to be the critical factors influencing the scores on the written and practical scores obtained on the Massachusetts Vocational Competency Examinations.

When the dependent variable was the written examination scores, those questions were as follows:

1) The number of years of work experience in the trade area of the test.

2) The number of years of teaching vocational, technical, occupational, business, or industrial arts courses.

3) The number of years of formal education completed in a degree or diploma granting institution.

When the dependent variable was the practical examination scores, those questions were as follows:

1) The number of years of work experience in the trade area of the test.

2) The number of years of teaching vocational courses in the trade area of the test.

3) The amount of formal training beyond high school in nondegree programs such as apprenticeships, on-the-job training, or professional institutes.

In Chapter 5, the findings will be presented separately for each of the occupations selected. The occupations included in this trade-by-trade analysis are:

Auto Repair, Carpentry, Culinary Arts, Electricity, Electronics, Machine Shop, and Metal Trades.

These occupations were chosen form the forty-five occupations covered by the Massachusetts Vocational Competency Testing Program for one or more of the following reasons:

1) Trades in which the largest number of candidates tested.

2) Trades which were licensed.

3) Trades in which a critical shortage of teachers existed at the time of the study.

Within each of these sections, the three research questions will be analyzed in order and all statistical information will be summarized in tables. The statistical analysis was done on the sum of the number of candidates for the four years of the study.

Auto Repair

The purpose of this study was to demonstrate the nature of the relationship between a candidate's occupational competency as measured by the Massachusetts Vocational Competency Examination and work experience, teaching experience, and educational background as previously defined Information presented in this section answers these questions for Auto Repair.

Research question #1: Is there a relationship between work experience and occupational competency as measured by the Massachusetts Vocational Competency Examination/written test?

Table 24 shows the number of candidates taking the Auto Repair written and practical examinations respectively. One hundred seven candidates took the Auto Repair written examination. Of these, 48% had six to twelve years of occupational experience in the trade. Sixty-two

candidates took the Auto Repair practical examination. Of these, forty percent had from six to twelve years of work experience.

TABLE 24
RESPONSES REGARDING WORK EXPERIENCE FOR AUTO REPAIR

RESPONSE	WRITTEN n	%	PRACTICAL n	%
≤6YRS	3	2.8	1	1.6
6-12YRS	51	47.7	25	40.3
13-18YRS	23	21.5	18	25.0
19-24YRS	16	15.0	9	14.5
≥24YRS	14	13.1	9	14.5
TOTAL	107	100	62	100

In Table 25, the number of candidates passing and failing the written examination are given. It should be noted that fifty-five percent of the candidates passed while forty-five percent failed the test. This resulted in a passing to failing ratio of ten percent. Candidates with over twenty-four years of work experience had a passing to failing ratio of twenty-nine percent. There were not enough candidates in the first interval to calculate a ratio.

TABLE 25
RELATIONSHIP OF WORK EXPERIENCE TO WRITTEN TEST SCORES/AUTO REPAIR

RESPONSE	PASS	FAIL	SUM	%P/F
≤6YRS	1	2	3	
6-12YRS	27	24	51	6%
13-18YRS	14	9	23	22%
19-24YRS	8	8	16	0
≥24YRS	9	5	14	29%
TOTAL	59	48	107	10%
Chi-square=1.63	degrees of freedom=4		p=.8	

When the Chi-square test was applied, however, the value achieved was smaller than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results are not statistically significant at the .05 level.

Table 26 shows the number of candidates passing and failing the practical examination, and their responses to the question about work experience. Examination of the results of the practical examination shows that overall, the passing to failing ratio is 13%. Candidates in the 13-18 year interval had a passing to failing ratio of 56%.

TABLE 26
RELATIONSHIP OF WORK EXPERIENCE TO PRACTICAL TEST SCORES/AUTO REPAIR

RESPONSE	PASS	FAIL	SUM	%P/F
≤6YRS	1	0	1	
6-12YRS	10	15	25	-20%
13-18YRS	14	4	18	+56%
19-24YRS	6	3	9	+33%
≥24YRS	4	5	9	-11%
TOTAL	35	27	62	+13%
Chi-square=7.76	degrees of freedom=4			p=.1

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom.This finding was not statistically significant at the .05 level.

Research question #2;Is there a relationship between teaching experience and occupational competency as measured by the Massachusetts Vocational Competency Examination/written test?

Table 27 shows the responses of candidates answering the question relative to teaching experience. It should be noted that on the written test 45% of the candidates responding to this question had no teaching experience, and an additional 29% had less than one year. On the practical exam, forty-two percent of the candidates responding had no teaching experience, and an additional twenty-six percent had less than one year.

TABLE 27
RESPONSES REGARDING TEACHING EXPERIENCE FOR AUTO REPAIR

RESPONSE	WRITTEN		PRACTICAL	
	n	%	n	%
NONE	48	44.9	26	41.9
<1YR	31	29.0	16	25.8
1-3YRS	16	15.0	11	17.7
4-6YRS	5	4.7	6	9.7
≥6YRS	7	6.5	3	4.8
TOTAL	107	100	62	100

In Table 28, the passing and failing number of candidates are given. It should be noted that candidates with one to three years of experience teaching vocational,technical, business, industrial arts or occupational education courses had a passing to failing ratio of 25%. There were not enough candidates in the fourth interval to calculate a ratio.

TABLE 28
RELATIONSHIP OF TEACHING EXPERIENCE TO WRITTEN TEST SCORES/AUTO REPAIR

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	25	23	48	+2%
<1YR	18	13	31	+16%
1-3YRS	10	6	16	+25%
4-6YRS	3	2	5	
≥6YRS	3	4	7	-14%
TOTAL	59	48	107	+10%
Chi-square=1.11		degrees of freedom=4		p=.9

When the chi-square test was applied, however, the value achieved was smaller than the critical value (9.48) for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Table 29 shows the relationship of the number of years experience teaching vocational courses in the trade area of the test and scores on the practical exam. Candidates with up to one year of teaching had a passing to failing ratio of thirty-eight percent compared to an overall ratio of thirteen percent.

TABLE 29
RELATIONSHIP OF TEACHING EXPERIENCE TO PRACTICAL TEST SCORES
AUTO REPAIR

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	14	12	26	+8%
<1YR	11	5	16	+38%
1-3YRS	5	6	11	-9%
4-6YRS	3	3	6	0%
≥6YRS	2	1	3	**
TOTAL	35	27	62	+13%
Chi-square=1.6		degrees of freedom=4		p=.8

When the chi-square test was applied, the value obtained was not larger than 9.48, the critical value for a table with four degrees of freedom. Therefore, this finding was not statistically significant at the .05 level.

Research question #3: Is there a relationship between educational background and occupational competency as measured by the Massachusetts Vocational Competency Examination/written test?

Table 30 presents data showing the total number of candidates responding to each category of the question relative to the number of years of education. It should be noted that candidates were required to have a high school diploma in order to qualify for the examination. However, there were ten candidates taking the written examinaton who indicated eleven years or less of education. Forty-four percent of the candidates had a high school diploma, and an additional thirty-seven percent had an associates degree. Of the candidates taking the practical examination, forty-six percent had more than twelve months of nondegree traning beyond high school

TABLE 30
RESPONSES REGARDING EDUCATIONAL BACKGROUND FOR AUTO REPAIR

RESPONSE	WRITTEN n	%	RESPONSE	PRACTICAL n	%
11YRS	10	9.3	NONE	5	8.2
HIGH SCH	47	43.9	3MOS	10	16.4
ASSO DEG	39	36.4	3-6MOS	13	21.3
BACH DEG	6	5.6	7-12MOS	5	8.2
GRAD WK	5	4.7	12MOS	28	45.9
TOTAL	107	100	TOTAL	61	100

Table 31 presents data relative to the years of educational background and passing and failing scores on the written examination for the four years of the study. Candidates with a Bachelor's degree had a passing to failing ratio of thirty-three percent, compared with the overall ratio of ten percent. As education increased beyond the bachelors level, the ratio increased to one hundred percent.

TABLE 31
RELATIONSHIP OF EDUCATION TO WRITTEN TEST SCORES/AUTO REPAIR

RESPONSE	PASS	FAIL	SUM	%P/F
≤11YRS	4	6	10	-20%
HIGH SCH	24	23	47	+2%
ASSO DEG	22	17	39	+13%
BACH DEG	4	2	6	+33%
GRAD WRK	5	0	5	+100%
TOTAL	59	48	107	+10%
Chi-square=5.6		degrees of freedom=4		p=.2

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. However, the largest value of Chi-square was obtained for the relationship between education and written test scores.

Table 32 shows the relationship of the number of months of formal training beyond the high school level that the candidate has had in nondegree programs such as apprenticeships, on-the-job training, or professional institutes and scores on the practical examination. Candidates with seven to twelve months of training had a passing to failing ratio of sixty percent, compared to eleven percent overall.

TABLE 32
RELATIONSHIP OF EDUCATION TO PRACTICAL TEST SCORES/AUTO REPAIR.

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	2	3	5	-20%
<3MOS	5	5	10	0%
3-6MOS	7	6	13	+8%
7-12MOS	4	1	5	+60%
≥12MOS	16	12	28	+14%
TOTAL	27	34	61	+11
Chi-square=1.86	degrees of freedom=4			p=.8

When the chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore the results are not statistically significant at the .05 level.

Table 33 summarizes the Chi-square values obtained for Auto Repair.

TABLE 33
SUMMARY OF CHI-SQUARE VALUES FOR AUTO REPAIR

QUESTION	CHI-SQUARE	DF	SIGNIFICANCE
	WRITTEN TEST		
E2	5.7	4	.2
W1	1.6	4	.8
T3	1.1	4	.9
	PRACTICAL TEST		
W1	7.8	4	.1
E1	1.9	4	.8
T4	1.8	4	.8

It is apparent from this table, that education has the strongest relationship to written test scores, followed by teaching experience and work experience. This is consistent with earlier findings from the regression analysis performed on scores from all trades.

It would appear that the Auto Repair candidate most likely to succeed on the written exam has over twenty-four years of work experience, one to three years of teaching experience, and a Bachelor's degree or beyond. Examination of the Chi-square values of the practical exam show that work experience has the largest effect on test scores, followed by education and teaching experience. It would appear that the candidate most likely to succeed on the practical examination would have 13-18 years of work experience, up to one year of teaching experience, and seven to twelve months of nondegree training.

Carpentry

Information presented in this section answers the research questions for the occupation carpentry.

Research question #1: Is there a relationship between work experience and occupational competency as measured by the Massachusetts Vocational Competency Examination/written test?

Table 34 shows the number of candidates taking the Carpentry examination and their responses to the question about the number of years of work experience. It should be noted that a requirement of six years of work experience in the trade is a prerequisite for a candidate to be eligible to take this test. However, three candidates claimed to have had less than the six year requirement. 50% of the candidates had 6-12 years of experience, and an additional 24% have had 13-18 years. Fifty-four percent of those taking the practical examination had from six to twelve years of experience, and an additional twenty-one percent had from thirteen to eighteen years of experience.

TABLE 34
RESPONSES REGARDING WORK EXPERIENCE FOR CARPENTRY

RESPONSE	WRITTEN		PRACTICAL	
	n	%	n	%
<6YRS	3	3.0	3	3.3
6-12YRS	50	49.5	49	54.4
13-18YRS	24	23.8	19	21.1
19-24YRS	12	11.9	8	8.9
≥24YRS	12	11.9	11	12.2
TOTAL	101	100.0	90	100.0

Table 35 presents data relative to the number of candidates passing and failing the written exam and their responses to the question about work experience. It should be noted from this table that 81% of those candidates taking the exam passed, while 19% failed. This results in a passing to failing ratio of sixty-two percent. There were not enough candidates in the first interval to compute the ratio. Candidates who had over twenty-four years of experience had a passing to failing ratio of eighty-three percent

TABLE 35
RELATIONSHIP OF WORK EXPERIENCE TO WRITTEN TEST SCORES/CARPENTRY

RESPONSE	PASS	FAIL	SUM	%P/F
$\leq$6YRS	2	1	3	
6-12YRS	39	11	50	39%
13-18YRS	20	4	24	67%
19-24YRS	10	2	12	67%
$\geq$24YRS	11	1	12	83%
TOTAL	82	19	101	62%
Chi-square=1.7	degrees of freedom=4			p=.8

When the Chi-square test was applied, the value obtained was less than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Table 36 shows the number of candidates passing and failing the practical examination, and their responses to the question about work experience. Examination of the table shows that the number passing is nearly equal to the number failing the practical examination. It should be noted that the passing to failing ratio for the 19-24 year interval is 50%, compared to the overall ratio of -2%.

TABLE 36
RELATIONSHIP OF WORK EXPERIENCE TO PRACTICAL TEST SCORES/CARPENTRY

RESPONSE	PASS	FAIL	SUM	%P/F
≤6YRS	1	2	3	
6-12YRS	21	28	49	-14%
13-18YRS	11	8	19	+16%
19-24YRS	6	2	8	+50%
≥24YRS	5	6	11	-9%
TOTAL	44	46	90	-2%
Chi-square=3.85	degrees of freedom=4			p=.4

When the Chi-square test was applied, the critical value (9.48) for a table with four degrees of freedom was not obtained. Therefore the results are not statistically significant at the .05 level.

Research question #2: Is there a relationship between teaching experience and occupational competency as measured by the Massachussetts Vocational Competency Examination?

Table 37 presents the data showing the total number of candidates who took the Carpentry examination, and their responses to the question about teaching experience. It should be noted that 41% of the candidates taking the written exam had no teaching experience, and an additional 26% of the candidates had less than one year of experience. Of the candidates taking the practical examination, fifty-three percent had no teaching experience, and an additional twenty-six percent had less than one year.

TABLE 37
RESPONSES REGARDING TEACHING EXPERIENCE FOR CARPENTRY

RESPONSE	WRITTEN		PRACTICAL	
	n	%	n	%
NONE	41	40.6	47	52.8
<1YR	26	25.7	23	25.8
1-3YRS	19	18.8	15	16.9
4-6YRS	4	4.0	1	1.1
≥6YRS	11	10.9	3	3.4
TOTAL	101	100.0	89	100.0

Table 38 shows the number of candidates passing and failing the Carpentry exam, and their responses to the question about teaching experience. There were not enough candidates in the fourth interval to compute a ratio. Candidates having more than six years of teaching experience had a passing to failing ratio of eighty-two percent compared to an overall ratio of sixty-two percent

TABLE 38
RELATIONSHIP OF TEACHING EXPERIENCE TO WRITTEN TEST SCORES/CARPENTRY

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	32	9	41	56%
<1YR	21	5	26	62%
1-3YRS	15	4	19	59%
4-6YRS	4	0	4	
≥6YRS	10	1	11	82%
TOTAL	82	19	101	62%
Chi-square=1.9	degrees of freedom=4			p=.7

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Table 39 shows the relationship of the number of years experience teaching vocational courses in the trade area of the test and scores on the practical examination. Candidates with up to one year of teching experience had a passign to failing ratio of twenty-two percent as compared to the overall ratio of negative one percent. There were not enough candidates in the fourth and fifth intervals to compute a ratio.

TABLE 39
RELATIONSHIP OF TEACHING EXPERIENCE TO PRACTICAL TEST SCORES/CARPENTRY

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	19	28	47	-19%
<1YR	14	9	23	+22%
1-3YRS	8	7	15	+6%
4-6YRS	0	1	1	
≥6YRS	3	0	3	
TOTAL	44	45	89	-1%

Chi-square=6.86 degrees of freedom=4 p=.1

When the Chi-square test was applied, the critical value was not obtained. Therefore, this result was not statistically significant at the .05 level.

Research question #3:Is there a relationship between educational background and occupational competency as measured by the Massachusetts Vocational Competency Examination?

In Table 40, the number of candidates taking the Carpentry examination are shown, with their responses to the question about educational background. It should be noted that a High School diploma, or its equivalent is required for a candidate to be eligible to take this exam. Notwithstanding this requirement, eight candidates claim to

have eleven years or less. 39% had a High School education, and an additional 26% possessed an Associates degree.

Of the candidates taking the practical examination, forty-three percent had more than twelve months of nondegree training beyond high school such as apprenticeships, on-the-job training, or professional institutes.

TABLE 40
RESPONSES REGARDING EDUCATIONAL BACKGROUND FOR CARPENTRY

RESPONSE	WRITTEN n	%	RESPONSE	PRACTICAL n	%
≤11YRS	8	7.9	NONE	21	24.4
HIGH SCH	39	38.6	≤3MOS	10	11.6
ASSO DEG	26	25.7	3-6MOS	9	10.5
BACH DEG	17	16.8	7-12MOS	9	10.5
GRAD WRK	11	10.9	≥12MOS	37	43.0
TOTAL	101	100.0	TOTAL	86	100.0

Table 41 shows the data relative to the number of candidates passing and failing this exam, and their responses to the question about educational background. As candidates' level of education increased, so did the passing to failing ratio.

TABLE 41
RELATIONSHIP OF EDUCATION TO WRITTEN TEST SCORES/CARPENTRY.

RESPONSE	PASS	FAIL	SUM	%P/F
≤11YRS	6	2	8	50%
HIGH SCH	31	8	39	59%
ASSO DEG	21	5	26	62%
BACH DEG	14	3	17	65%
GRAD WRK	10	1	11	82%
TOTAL	82	19	101	62%
Chi-square=0.97	degrees of freedom=4			p=.9

When the Chi-square test was applied, however, the critical value(9.48) for a table with four degrees of freedom was not obtained. Therefore, the results were not statistically significant at the .05 level.

Table 42 shows the relationship of the number of months of formal training beyond high school that the candidate has had in nondegree programs such as apprenticeships, on-the-job training, or professional institutes and scores on the practical examination. It should be noted that candidates with up to three months of nondegree training beyond high school had a passing to failing ratio of 40% compared to an overall ratio of zero.

TABLE 42
RELATIONSHIP OF EDUCATION TO PRACTICAL TEST SCORES/CARPENTRY

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	12	9	21	+14%
<3MOS	7	3	10	+40%
3-6MOS	4	5	9	-11%
7-12MOS	4	5	9	-11%
≥12MOS	16	21	37	-14%
TOTAL	43	43	86	0
Chi-square=2.92	degrees of freedom=4			p=.6

When the Chi-square test was applied, the value obtained was smaller than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Table 43 summarizes the Chi-square values obtained for the Carpentry examinations.

TABLE 43
SUMMARY OF CHI-SQUARE VALUES FOR CARPENTRY

QUESTION	CHI-SQUARE	DEG OF FREEDOM	SIGNIFICANCE
	WRITTEN TEST		
T3	1.9	4	.7
W1	1.7	4	.8
E2	0.97	4	.9
	PRACTICAL TEST		
T4	6.86	4	.1
W1	3.85	4	.4
E1	2.92	4	.6

It can be seen from this table that teaching experience has the greatest effect on Carpentry written test scores, followed by work experience. Education has the least effect. The candidate most likely to succeed on the Carpentry written exam would have more than six years teaching experience, course work beyond a Bachelor's degree, and more than 24 years of work experience. On the practical exam, teaching experience is the most important, followed by work experience and educational experience has the least effect. The candidate most likely to succeed on the practical exam would have nineteen to twenty-four years of work experience, up to one year of teaching experience, and up to 3 months of nondegree training beyond high school.

Culinary Arts

Information presented in this section answers the research questions for the occupation Culinary Arts.

> Research question #1: Is there a relationship between work experience and occupational competency as measured by the Massachusetts Vocational Competency Examination?

In Table 44, the number of candidates who took the Culinary Arts examinations are shown, and their responses to the question about work experience are given. It should be noted that a work experience requirement of six years is mandatory for a candidate to be eligible for this exam. Notwithstanding, two candidates have less than the six year requirement. Fifty-four percent of the candidates taking the written test had 6-12 years of experience, and an additional 22% had 13-18 years. Fifty-one percent of the candidates taking the practical exam had six to twelve years of work experience, and an additional twenty-six percent had thirteen to eighteen years of experience.

TABLE 44
RESPONSES REGARDING WORK EXPERIENCE FOR CULINARY ARTS

RESPONSE	WRITTEN		PRACTICAL	
	n	%	n	%
≤6YRS	2	2.4	1	1.8
6-12YRS	45	54.2	28	50.9
13-18YRS	18	21.7	14	25.5
19-24YRS	12	14.5	6	10.9
≥24YRS	6	7.2	6	10.9
TOTAL	83	100	55	100

Table 45 shows the number of candidates passing and failing the Culinary Arts written exam, and their responses relative to work experience. Fifteen percent of the candidates taking this test failed,

while eighty-five percent passed. This resulted in a passing to failing ratio of +70%. Only the candidates in the interval 19-24 years had a greater passing to failing ratio.

TABLE 45
RELATIONSHIP OF WORK EXPERIENCE TO WRITTEN TEST SCORES/CULINARY ARTS

RESPONSE	PASS	FAIL	SUM	%P/F
<6YRS	2	0	2	
6-12YRS	38	7	45	+69%
13-18YRS	15	3	18	+67%
19-24YRS	11	1	12	+83%
≥24YRS	5	1	6	+66%
TOTAL	71	12	83	+71%
Chi-square=.84	degrees of freedom=4		p=.9	

When the Chi-square test was applied, the value obtained was smaller than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Table 46 shows the number of candidates passing and failing the practical examination, and their responses to the question about work experience. Examination of the results of the practical exam shows that, overall, the ratio of passing to failing is 60%. Candidates in the 6-12 year interval had a passing to failing ratio of 86%.

TABLE 46
RELATIONSHIP OF WORK EXPERIENCE TO PRACTICAL TEST SCORES/CULINARY ARTS

RESPONSE	PASS	FAIL	SUM	%P/F
≤6YRS	1	0	1	
6-12YRS	26	2	28	+86%
13-18YRS	9	5	14	+29%
19-24YRS	5	1	6	+67%
≥24YRS	3	3	6	0
TOTAL	44	11	55	60%
Chi-square =8.72		degrees of freedom=4		.06

When the Chi-square test was applied, the value obtained, while not larger than 9.48, was very close in size. Therefore, the results are statistically significant at the .06 level.

Research question #2; Is there a relationship between teaching experience and occupational competence as measured by the Massachusetts Vocational Competency Examinations?

Table 47 presents the number of candidates who took the Culinary Arts examination over the four years of the study, and their responses on the question about teaching experience. It should be noted that 47% of the candidates taking the written examination, had no teaching experience, and an additional 19% had less than one year of teaching experience. Of those taking the practical examination, forty percent had no experience, and an additional twenty-six percent had less than one year.

TABLE 47
RESPONSES REGARDING TEACHING EXPERIENCE FOR CULINARY ARTS

RESPONSE	WRITTEN n	%	PRACTICAL n	%
NONE	39	47.0	22	40.0
<1YR	16	19.3	14	25.5
1-3YRS	16	19.3	14	25.5
4-6YRS	8	9.6	3	5.5
≥6YRS	4	4.8	2	3.6
TOTAL	83	100	55	100

Table 48 shows the number of candidates passing and failing the written exam, and their responses to the question about teaching experience. Candidates in the intervals of 'less than one year' and 'one to three years' of teaching experience had a higher passing to failing ratio than overall. Candidates with more than three years of teaching experience did not do as well.

TABLE 48
RELATIONSHIP OF TEACHING EXPERIENCE TO WRITTEN TEST SCORES
CULINARY ARTS

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	36	3	39	+85%
<1YR	14	2	16	+75%
1-3YRS	11	5	16	+36%
4-6YRS	6	2	8	+50%
≥6YRS	4	0	4	
TOTAL	71	12	83	+71%
Chi-square=6.5	degrees of freedom=4		.2	

Table 49 shows the relationship of the number of years experience teaching vocational courses in the trade area of the test and scores on the practical exam. The passing to failing ratio of those

candidates with less than one year of experience is above the overall ratio. When experience has passed the one year mark, the passing to failing ratio is 46%, less than the overall ratio. This may be explained by the fact that failing candidates were allowed to teach for three years, while trying to pass the test. If the candidate failed on the third try, s/he had to return to the work force and re-apply to the Division at least one year later.

TABLE 49
RELATIONSHIP OF TEACHING EXPERIENCE TO PRACTICAL TEST SCORES
CULINARY ARTS

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	20	2	22	+82%
<1YR	12	2	14	+71%
1-3YRS	8	6	14	+14%
4-6YRS	3	0	3	
≥6YRS	1	1	2	
TOTAL	44	11	55	+60%
Chi-square=8.36	degrees of freedom=4		p=.08	

When the Chi-square test was applied, the value obtained was very close in size to the critical value (9.48) for a table with four degrees of freedom. Therefore, the results are statistically significant at the .08 level.

> Research question #3; Is there a relationship between educational background and occupational competency as measured by the Massachusetts Vocational Competency examination?

Table 50 summarizes the number of candidates who took the Culinary Arts examination and their responses to the question about education. It should be noted that, although the minimum requirement

for a person to be eligible to take this test is a high school diploma, four candidates answered eleven years of education or less. Nearly 46% of the candidates had an associates degree or the equivalent.

TABLE 50
RESPONSES REGARDING EDUCATIONAL BACKGROUND FOR CULINARY ARTS

RESPONSE	WRITTEN n	%	RESPONSE	PRACTICAL n	%
<11YRS	4	4.8	NONE	11	21.1
HIGH SCH	19	22.9	3MOS	3	5.8
ASSO DEG	39	47.0	3-6MOS	5	9.6
BACH DEG	13	15.7	7-12MOS	9	17.3
GRAD WRK	8	9.6	12MOS	24	46.3
TOTAL	83	100.0	TOTAL	52	100.0

Table 51 shows the data relative to the number of candidates passing and failing the written and their number of years of formal education. Candidates with a Bachelor's degree had a passing to failing ratio of eighty-five percent as compared to a ratio of seventy-one percent.

TABLE 51
RELATIONSHIP OF EDUCATIONAL BACKGROUND TO WRITTEN TEST SCORES
CULINARY ARTS

RESPONSE	PASS	FAIL	SUM	%P/F
<11YRS	2	2	4	
HIGH SCH	16	3	19	+68%
ASSO DEG	34	5	39	+74%
BACH DEG	12	1	13	+85%
GRAD WRK	7	1	8	+75%
TOTAL	71	12	83	+71%
Chi-square=4.7	degrees of freedom=4		p=.3	

When the Chi-square test was applied, however, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore the results were not statistically significant at the .05 level.

Table 52 shows the relationship of the number of months of formal training beyond high shcool that the candidate has had in nondegree programs such as apprenticeships, on-the-job training or professional institutes and scores on the practical examination. Candidates with no training other than high school show the highest passing to failing ratio. One possible explanation for this is that the majority of Culinary arts candidates had education beyond high school in degreed programs, and did not participate in this kind of training.

TABLE 52
RELATIONSHIP OF EDUCATION TO PRACTICAL TEST SCORES/CULINARY ARTS

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	10	1	11	+82%
<3MOS	3	0	3	
3-6MOS	4	1	5	+60%
7-12MOS	3	6	9	-33%
≥12MOS	21	3	24	+75%
TOTAL	41	11	52	+58%
Chi-square=14.02	degrees of freedom=4		p=.01	

When the Chi-square test was applied, the value obtained was larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, this finding was significant at the .01 level.

Table 53 summarizes the Chi-square values for Culinary Arts. Work experience, and teaching experience had the most effect on written test scores, with education third. The reverse was true for the practical test scores. Education had the most pronounced effect, followed by work experience and teaching experience at nearly equal values.

TABLE 53
SUMMARY OF CHI-SQUARE VALUES FOR CULINARY ARTS

QUESTION	CHI-SQUARE	DF	SIGNIFICANCE
	WRITTEN TEST		
T3	6.5	4	.2
E2	4.7	4	.3
W1	0.8	4	.9
	PRACTICAL TEST		
E1	14.02	4	.01
W1	8.72	4	.07
T4	8.36	4	.08

The candidate most likely to succeed in the written exam would have 19-24 years of experience, no experience teaching vocational courses at the secondary level, and a Bachelor's degree or beyond. The candidate most likely to succeed in the practical exam would have 6-12 years of work experience, one to three years experience teaching vocational courses in the trade area of the test, and no nondegree training beyond high school.

Electricity

Information presented in this section answers the research questions for the occupation Electricity.

> Research question #1: Is there a relationship between work experience and occupational competence as measured by the Massachusetts Vocational Competency Examination?

In Table 54, the number of candidates taking the Electricity examinations are shown, and their responses to the question about work experience. It should be noted that six years of work experience is mandatory for a candidate to be eligible to take this examination. Notwithstanding this requirement, four candidates indicate less than six years of work experience in the trade area of this test. Nearly one half of the candidates taking this test have six to twelve years of work experience in the trade area of the test, and one-third more have thirteen to eighteen years of experience.

TABLE 54
RESPONSES REGARDING WORK EXPERIENCE FOR ELECTRICITY

RESPONSE	WRITTEN		PRACTICAL	
	n	%	n	%
<6YRS	0	0	0	0
6-12YRS	34	52.3	33	56.9
13-18YRS	20	30.8	16	27.6
19-24YRS	8	12.3	6	10.3
≥24YRS	3	4.6	3	5.2
TOTAL	65	100.0	58	100.0

Table 55 shows the number of candidates passing and failing the Electricity written examination, and their responses to the question about work experience. It should be noted from this table that 31% of the candidates failed, and 69% passed the written

examination. This results in a passing to failing ratio of +38%. Candidates having thirteen to eighteen years of experience had a passing to failing ratio of fifty percent, as compared to a thirty-eight percent ratio overall. Not enough candidates fall into the first and fifth intervals to evaluate the passing to failing ratio.

TABLE 55
RELATIONSHIP OF WORK EXPERIENCE TO WRITTEN TEST SCORES/ELECTRICITY

RESPONSE	PASS	FAIL	SUM	%P/F
<6YRS	0	0	0	
6-12YRS	24	10	34	+41%
13-18YRS	15	5	20	+50%
19-24YRS	4	4	8	0%
≥24YRS	2	1	3	
TOTAL	45	20	65	+38%
Chi-square=1.7	degrees of freedom=30		p=.6	

When the Chi-square test was applied, the value obtained was smaller than the critical value for a table with three degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Table 56 shows the numbers of candidates passing and failing the practical examination, and their responses to the question about work experience. Sixty percent of the candidates taking this exam passed, while forty percent failed. This results in a passing to failing ratio of twenty percent. Examination of the results shows that candidates in the six to twelve year interval had the most success on the practical exam with thirty three percent more passing than failing. Not enough candidates fell into the first and fifth intervals to evaluate a passing to failing ratio.

TABLE 56
RELATIONSHIP OF WORK EXPERIENCE TO PRACTICAL TEST SCORES/ELECTRICITY

RESPONSE	PASS	FAIL	SUM	%P/F
<6YRS	0	0	0	
6-12YRS	22	11	33	+33%
13-18YRS	8	8	16	0
19-24YRS	3	3	6	0
≥24YRS	2	1	3	
TOTAL	35	23	58	+20%
Chi-square=1.6	degrees of freedom=3		p=.7	

When the Chi-square test was applied, the value obtained was not larger than the critical value (7.81) for a table with three degrees of freedom. (This table is lacking one complete row, thus the degrees of freedom is three.) Therefore, the result is not statistically significant at the .05 level.

Research question #2: Is there a relationship between teaching experience and occupational competency as measured by the Massachusetts Vocational Competency Examination?

Table 57 presents the number of candidates taking the electricity examination and their responses to the question about teaching experience. Thirty-five percent of the candidates for the written test had no teaching experience, and an additional forty percent had less than one year. Forty-one percent of the candidates for the practical examination had no experience while an additional forty percent had less than one year teaching vocational courses at the secondary level.

TABLE 57
RESPONSES REGARDING TEACHING EXPERIENCE FOR ELECTRICITY

RESPONSE	WRITTEN n	%	PRACTICAL n	%
NONE	23	35.4	24	41.4
<1YR	26	40.0	23	39.7
1-3YRS	15	23.1	11	19.0
4-6YRS	1	1.5	0	0
≥6YRS	0	0	0	0
TOTAL	65	100.0	58	100.0

Table 58 shows the number of candidates passing and failing the written examination, and their responses to the question about the number of years teaching vocational, technical, business, or industrial arts courses at the secondary level. Fifty-four percent more candidates having less than one year of teaching experience passed than failed the exam, compared to an overall ratio of thirty-eight percent. There were not enough candidates in the fourth and fifth intervals to evaluate the passing to failing ratio.

TABLE 58
RELATIONSHIP OF TEACHING EXPERIENCE TO WRITTEN TEST SCORES/ELECTRICITY

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	16	7	23	+39%
<1YR	20	6	26	+54%
1-3YRS	8	7	15	+ 7%
4-6YRS	1	0	1	
≥6YRS	0	0	0	
TOTAL	45	20	65	+38%
Chi-square=6.2	degrees of freedom=3		p=.4	

When the Chi-square test was applied, the critical value (7.81) for a table with three degrees of freedom was not obtained. Therefore, the

result was not statistically significant at the .05 level.

Table 59 shows the relationship of the number of years of experience teaching vocational courses at the secondary level, and scores on the practical examination.

TABLE 59
RELATIONSHIP OF TEACHING EXPERIENCE TO PRACTICAL TEST SCORES
ELECTRICITY

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	11	13	24	-8%
<1YR	19	4	23	+65%
1-3YRS	5	6	11	-9%
4-6YRS	0	0	0	
≥6YRS	0	0	0	
TOTAL	35	23	58	+21%
Chi-square=7.9	degrees of freedom=2		p=.02	

When the Chi-square test was applied, the value obtained was larger than the critical value (5.99) for a table with two degrees of freedom. Therefore, the result is statistically significant at the .02 level.

Research question #3; Is there a relationship between educational background and occupational competency as measured by the Massachusetts Vocational Competency Examination?

Table 60 summarizes the number of candidates taking the electricity examination and their responses to the question about educational background.

TABLE 60
RESPONSES REGARDING EDUCATIONAL BACKGROUND FOR ELECTRICITY

RESPONSE	WRITTEN n	%	RESPONSE	PRACTICAL n	%
<11YRS	0	0	NONE	2	3.4
HIGH SCH	39	60.0	3MOS	4	6.9
ASSO DEG	20	30.8	3-6MOS	7	12.1
BACH DEG	4	6.2	7-12MOS	7	12.1
GRAD WRK	2	3.1	12MOS	38	65.5
TOTAL	65	100.0	TOTAL	58	100.0

Examination of this data indicates that of the sixty-five candidates who took the Electricity written examination, nearly sixty percent had a high school diploma. An additional thirty percent had an associates degree. Of the fifty-eight candidates who took the practical examination sixty-five percent had more than twelve months of nondegree training beyond the high school level.

Table 61 shows the relationship of the number of years of formal education and the number of passing and failing candidates on the written examination.

TABLE 61
RELATIONSHIP OF EDUCATIONAL BACKGROUND TO WRITTEN TEST SCORES
ELECTRICITY

RESPONSE	PASS	FAIL	SUM	%P/F
<11YRS	0	0	0	
HIGH SCH	26	13	39	+33%
ASSO DEG	16	4	20	+60%
BACH DEG	2	2	4	
GRAD WRK	1	1	2	
TOTAL	45	20	65	+38%
Chi-square=2.25	degrees of freedom=3		p=.5	

Candidates in the Associates degree interval showed the best success on the written exam. The passing to failing ratio was sixty percent, compared to an overall ratio of thirty-eight percent. When the Chi-square test was applied, the value obtained was not larger than the critical value (7.81) for a table with three degrees of freedom. Therefore, the finding was not statistically significant at the .05 level.

Table 62 shows the relationship of the practical test scores to the number of months of nondegree training beyond the high school level in programs such as apprenticeships, on-the-job training, or professional institutes. It should be noted that sixty percent passed the practical examination, while forty percent failed.

TABLE 62
RELATIONSHIP OF PRACTICAL TEST SCORES TO EDUCATIONAL BACKGROUND
ELECTRICITY

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	1	1	2	
<3MOS	2	2	4	
3-6MOS	6	1	7	+71
7-12MOS	4	3	7	+14
≥12MOS	22	16	38	+16
TOTAL	35	23	58	+21%
Chi-square=2.28	degrees of freedom=4		p=.7	

Examination of this table shows that candidates who had three to six months of training had the best passing to failing ratio. when the Chi-square test was applied, however, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the findings were not statistically significant.

Table 63 summarizes the Chi-square values obtained for the occupation electricity.

TABLE 63
SUMMARY OF CHI-SQUARE VALUES FOR ELECTRICITY

QUESTION	CHI-SQUARE	DF	SIGNIFICANCE
	WRITTEN TEST		
T3	2.9	3	.4
E2	2.3	3	.5
W1	1.7	3	.6
	PRACTICAL TEST		
T4	7.9	2	.02
E1	2.28	4	.7
W1	1.59	3	.7

The candidate most likely to succeed on the written electricity examination would have up to one year of experience teaching vocational, technical, occupational, business, or industrial arts courses at the secondary level, an associates degree, and thirteen to eighteen years of work experience. The candidate most likely to succeed on the practical examination would have up to one year of experience teaching vocational courses in the trade area of this test at the secondary level, three to six months of nondegree training beyond high school, and six to twelve years of work experience.

Electronics

Information presented in this section answers the research questions for the occupation Electronics.

> Research question #1: Is there a relationship between work experience and occupational competency as measured by the Massachusetts Vocational Competency Examination?

In Table 64, the number of candidates taking the Electronics examination are shown, and their responses to the question about work experience It should be noted that six years of experience are required by the Division of Occupational Education. In certain cases, a limited number of years of experience may be replaced by coursework in the trade area of the test. From this table, twelve candidates appear to have taken advantage of this option. In addition, thirty-three percent of the candiates for this test have from six to twelve years of experience.

TABLE 64
RESPONSES REGARDING WORK EXPERIENCE FOR ELECTRONICS

RESPONSE	WRITTEN		PRACTICAL	
	n	%		n
≤6YRS	15	15.3	1	2.2
6-12YRS	34	34.7	21	45.7
13-18YRS	22	22.4	9	19.6
19-24YRS	15	15.3	9	19.6
≥24YRS	12	12.2	6	13.0
TOTAL	98	100.0	46	100.0

Table 65 shows the numbers of candidates passing and failing the Electronics written examination, and their responses to the question

about work experience. It should be noted from this table that fifty-three percent of the candidates taking the Electronics examination passed, and forty-seven percent failed. This results in a passing to failing ratio of six percent. Candidates with six to twelve years of experience had the highest passing to failing ratio. Thirty-five percent more candidates passed than failed in this interval.

TABLE 65
RELATIONSHIP OF WORK EXPERIENCE TO WRITTEN TEST SCORES/ELECTRONICS

RESPONSE	PASS	FAIL	SUM	%P/F
≤6YRS	8	7	15	7%
6-12YRS	23	11	34	35%
13-18YRS	12	10	11	9%
19-24YRS	7	8	15	-7%
≥24YRS	2	10	12	-67%
TOTAL	52	46	98	6%
Chi-square=9.55	degrees of freedom=4		p=.05	

When the Chi-square test was applied, however, the value obtained was larger than the critical value(9.48) for a table with four degrees of freedom. Therefore the results were statistically significant at the .05 level.

Table 66 shows the number of candidates passing and failing the practical examination, and their responses to the question about work experience. Eleven percent of the candidates taking the Electronics practical examination failed, while eighty-nine percent passed. This results in a pasing to failing ratio of seventy-eight percent. The passing to failing ratio for candidates with thirteen to eighteen

years of work experience was one hundred percent, compared to the seventy-eight percent ratio overall. There were not a sufficient number of candidates with less than six years of experience to compute the passing to failing ratio.

TABLE 66
RELATIONSHIP OF WORK EXPERIENCE TO PRACTICAL TEST SCORES/ELECTRONICS

RESPONSE	PASS	FAIL	SUM	%P/F
<6YRS	1	0	1	
6-12YRS	18	3	21	+71%
13-18YRS	9	0	9	+100%
19-24YRS	9	0	9	+100%
≥24YRS	4	2	6	+50%
TOTAL	41	5	46	+78%
Chi-square=5.69	degrees of freedom=4		p=.2	

When the Chi-square test was applied, however, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Research question #2: Is there a relationship between teaching experience and occupational competency as measured by the Massachusetts Vocational Competency examination?

Table 67 presents the number of candidates taking the Electronics examination and their responses to the question about teaching experience. Twenty-four percent of the candidates takingthis examnation had no experience, and an additional forty-three percent had less than one year.

TABLE 67
RESPONSES REGARDING TEACHING EXPERIENCE FOR ELECTRONICS

RESPONSE	WRITTEN n	%	PRACTICAL n	%
NONE	22	22.4	14	30.4
<1YR	41	41.8	20	43.5
1-3YRS	24	24.5	9	19.6
4-6YRS	7	7.1	2	4.3
≥6YRS	4	4.1	1	2.2
TOTAL	98	100.0	46	100.0

Table 68 shows the numbers of candidates passing and failing the written Electronics examination, and their responses to the question about the number of years teaching vocational, technical, business, or industrial arts courses at the secondary level. Candidates having up to one year of teaching experience had a passing to failing ratio of thirty-seven percent, as compared to the overall ratio of six percent.

TABLE 68
RELATIONSHIP OF TEACHING EXPERIENCE TO WRITTEN TEST SCORES/ELECTRONICS

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	8	14	22	-27%
<1YR	28	13	41	36%
1-3YRS	11	13	24	-8%
4-6YRS	3	4	7	-14%
≥6YRS	2	2	4	
TOTAL	52	46	98	6%
Chi-square=7.1	degrees of freedom=4		p=.1	

When the Chi-square test was applied, however, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Table 69 shows the numbers of candidates passing and failing the practical examination and the number of years of experience teaching vocational courses at the secondary level. No particular category has a passing to failing ratio that is different from the overall ratio of seventy-eight percent. Threrfore, it can be concluded that teacing vocational courses at the secondary level is idependent of practical test scores.

TABLE 69
RELATIONSHIP OF TEACHING EXPERIENCE TO PRACTICAL TEST SCORES
ELECTRONICS

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	12	2	14	+71%
<1YR	18	2	20	+80%
1-3YRS	8	1	9	+77%
4-6YRS	2	0	2	
≥6YRS	1	0	1	
TOTAL	41	5	46	+78%
Chi-square=0.55	degrees of freedom=4		p=.9	

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Research question#3; Is there a relationship between educational background and occupational competency as measured by the Massachusetts Vocational Competency examination?

Table 70 shows the number of candidates taking the Electronics examination and their responses to the question about educational background. It should be noted that a minimum requirement for a

candidate to be eligible to take this examination is a high school diploma. Even so, two candidates indicated eleven years or less of education. Examination of this data shows that forty percent of the candidates taking the Electronics examination had an Associates degree, and thirty-one percent had a Bachelor's degree or beyond.

TABLE 70
RESPONSES REGARDING EDUCATIONAL BACKGROUND FOR ELECTRONICS

RESPONSE	WRITTEN n	%	RESPONSE	PRACTICAL n	%
≤11YRS	4	4.1	NONE	8	17.4
HIGH SCH	17	17.3	<3MOS	1	2.2
ASSO DEG	42	42.9	3-6MOS	1	2.2
BACH DEG	20	20.4	7-12MOS	7	15.2
GRAD WRK	15	15.3	≥12MOS	29	63.0
TOTAL	98	100.0	TOTAL	46	100.0

Table 71 shows the number of candidates passing and failing the Electronics written examination and their responses to the question about years of formal education. Examination of the data shows that fifty-three percent of the candidates taking the Electronics examination passed, while forty-seven percent failed. This results in a passing to failing ratio of six percent overall. Candidates with an associates degree and a bachelor's degree have a slightly higher passing to failing ratio: thirty-five and thirty-seven percent respectively.

TABLE 71
RELATIONSHIP OF EDUCATIONAL BACKGROUND TO WRITTEN TEST SCORES
ELECTRONICS

RESPONSE	PASS	FAIL	SUM	%P/F
≤11YRS	1	3	4	
HIGH SCH	11	6	17	+29%
ASSO DEG	22	20	42	+ 5%
BACH DEG	11	9	20	+10%
GRAD WRK	7	8	15	- 7%
TOTAL	52	46	98	+ 6%
Chi-square=2.47	degrees of freedom=4		p=.6	

When the Chi-square test was applied, however, the value obtained was not larger thant the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Table 72 shows the relationship of practical test scores and the number of months of nondegree training beyond the high school level. Examination of this data shows that those candidates with more than one year of such training had a higher passing to failing ratio than the overall ratio of seventy-eight percent. Eighty-six percent more candidates in this interval passed than failed .

TABLE 72
RELATIONSHIP OF PRACTICAL TEST SCORES TO EDUCATIONAL BACKGROUND
ELECTRONICS

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	7	1	8	+75%
<3MOS	1	0	1	
3-6MOS	0	1	1	
7-12MOS	6	1	7	+71
≥12MOS	27	2	29	+86%
TOTAL	41	5	46	+78%
Chi-square=8.9	degrees of freedom=4		p=.06	

When the Chi-square test was applied, the value obtained, while not larger than the critical value (9.48) for a table with four degrees of freedom, was very close. This finding was statistically significant at the .06 level.

Table 73 summarizes the Chi-square values obtained for the occupation Electronics.

TABLE 73
SUMMARY OF CHI-SQUARE VALUES FOR ELECTRONICS

QUESTION	CHI-SQUARE	DF	SIGNIFICANCE
	WRITTEN TEST		
W1	9.6.	4	.05
T3	7.1	4	.1
E2	2.5	4	.6
	PRACTICAL TEST		
E1	8.9	4	.06
W1	5.69	4	.2
T4	.55	4	.96

The candidate most likely to succeed on the written test would have six to twelve years of work experience, a High School education, and up to one year of teaching experience. The candidate most likely to succeed on the practical examination would have thirteen to twenty-fours of work experience, more than one year of nondegree training, and any amount of teaching experience.

Machine Shop

Information presented in this section answers the research questions for the occupation Machine Shop.

> Research question #1:Is there a relationship between work experience and occupational competence as measured by the Massachusetts Vocational Competency Examination?

Table 74 shows the number of candidates taking the Machine Shop examination and their responses to the question about work experience. It should be noted that a minimum of six years of work experience was mandatory for a candidate to be eligible to take this examination. However, four candidates indicated less than six years of work experience. Nearly one half of the candiates taking this examination had from six to twelve years of work experience. An additional twenty-two pecent had more than twenty-four years of experience.

TABLE 74
RESPONSES REGARDING WORK EXPERIENCE FOR MACHINE SHOP

RESPONSE	WRITTEN		PRACTICAL	
	n	%	n	%
<6YRS	4	4.3	2	3.0
6-12YRS	48	51.1	33	49.3
13-18YRS	14	14.9	12	17.9
19-24YRS	10	10.6	6	9.0
>24YRS	18	19.1	14	20.9
TOTAL	94	100.0	67	100.0

Table 75 shows the number of candidates passing and failing the written examination, and their responses to the question about work experience. Thirty-six percent of those taking the written examination failed, while sixty-four percent passed. This resulted in a passing to failing ratio of twenty-eight percent. Candiates with six to twelve years of work experience had a passing to failing ratio of sixty-three percent. There were not enough candidates in the first interval to compute the passing to failing ratio.

TABLE 75
RELATIONSHIP OF WORK EXPERIENCE TO WRITTEN TEST SCORES/MACHINE SHOP

RESPONSE	PASS	FAIL	SUM	%P/F
≤6YRS	2	2	4	
6-12YRS	29	19	48	62.5%
13-18YRS	10	4	14	43%
19-24YRS	7	3	10	40%
≥24YRS	12	6	18	33.3%
TOTAL	60	34	94	28%
Chi-square=1.15		degrees of freedom=4		p=.9

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Table 76 shows the number of candidates passing and failing the practical examination, and their responses to the question about work experience. Sixty-three percent of the candidates for the Machine Shop practical examination failed, while thirty-seven percent passed. This resulted in a passing to failing ratio of negative twenty-five percent (Rounded to the nearest whole percent). Those candidates with nineteen to twenty-four years of work experience had a passing to failing ratio of thirty-three percent, and those with over twenty-four years of experience had a ratio of fourteen percent, compared to an overall passing to failing ratio of negative twenty-five percent.

TABLE 76
RELATIONSHIP OF WORK EXPERIENCE TO PRACTICAL TEST SCORES
MACHINE SHOP

RESPONSE	PASS	FAIL	SUM	%P/F
<6YRS	0	2	2	
6-12YRS	11	22	33	-33%
13-18YRS	2	10	12	-66%
19-24YRS	4	2	6	+33%
24 YRS	8	6	14	+14%
TOTAL	25	42	67	-25%
Chi-square=8.16		degrees of freedom=4		p=.08

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Research question #2: Is there a relationship between teaching experience and occupational competency as measured by the Massachusetts Vocational Competency Examination?

Table 77 shows the numbers of candidates taking the Machine Shop examination and their responses to the question about teaching experience. Thiry-four percent of the candiates had no teaching experience, and an additional thirty percent had less than one year.

TABLE 77
RESPONSES REGARDING TEACHING EXPERIENCE FOR MACHINE SHOP

RESPONSE	WRITTEN		PRACTICAL	
	n	%	n	%
NONE	41	43.6	29	43.3
$\leq$1YR	28	29.8	33	49.3
1-3YRS	16	17.0	12	17.9
4-6YRS	6	6.4	6	9.0
$\geq$6YRS	3	3.2	14	20.9
TOTAL	94	100.0	67	100.0

Table 78 shows the number of candidates passing and failing the written examination and their responses to the number of years of teaching vocational, occupational, technical, business, or industrial arts courses at the secondary level. Those candidates who had up to one year of teaching experience had a passing to failing ratio of fifty percent, compared to the overall ratio of twenty-eight percent. There were not enough candidates in the 'over six years' interval to compute a passing to failing ratio.

TABLE 78
RELATIONSHIP OF TEACHING EXPERIENCE TO WRITTEN TEST SCORES/MACHINE SHOP

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	20	21	41	-2%
<1YR	21	7	28	50%
1-3YRS	11	5	16	38%
4-6YRS	5	1	6	67%
≥6YRS	3	0	3	
TOTAL	60	34	94	28%
Chi-square=8.4	degrees of freedom=4		p=.07	

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant.at the .05 level

Table 79 shows the number of candidates passing and failing the practical examination and their responses to the question about teaching vocational courses at the secondary level. Candidates with up to one year of teaching experience had a passing to failing ratio of negative four percent, compared to a negative twenty-five percent ratio overall.

TABLE 79
RELATIONSHIP OF TEACHING EXPERIENCE TO PRACTICAL TEST SCORES
MACHINE SHOP

RESPONSE	FAIL	PASS	SUM	%P/F
NONE	20	09	29	-38%
<1YR	13	12	25	-4%
1-3YRS	5	4	9	-11%
4-6YRS	4	0	4	
≥6YRS	0	0	0	
TOTAL	42	25	67	-25%
Chi-square=4.28		degrees of freedom=3		

When the Chi-square test was applied, the result was not larger than the critical value for a table with three degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Research question #3: Is there a relationship between educational background and occupational competency as measured by the Massachusetts Vocational Competency Examinations?

Table 80 summarizes the number of candidates taking the Machine Shop examinations and their responses to the question about educational background. It should be noted that a high school diploma is a minimum requirement for candidates to be eligible to take this examination. Even so, one candidate indicated less than twelve years of education. Over half the candidates taking this examination had a high school diploma, and an additional thirty-four percent had an associates degree.

TABLE 80
RESPONSES REGARDING EDUCATIONAL BACKGROUND FOR MACHINE SHOP

RESPONSE	WRITTEN n	%	RESPONSE	PRACTICAL n	%
<11YRS	1	1.1	NONE	10	14.9
HIGH SCH	47	50.0	<3MOS	2	3.0
ASSO DEG	32	34.0	3-6MOS	12	17.9
BACH DEG	10	10.6	7-12MOS	6	9.0
GRAD WRK	4	4.3	≥12MOS	37	55.2
TOTAL	94	100.0	TOTAL	67	100.0

Table 81 shows the relationship of the number of years of formal education in a degree granting institution and the number of candidates passing and failing the written examination. Candidates with a Bachelor's degree had a passing to failing ratio of eighty percent, as compared to the overall ratio of twenty-eight percent.There were not enough candidates in the first and fifth intervals to compute the ratio.

TABLE 81
RELATIONSHIP OF WRITTEN TEST SCORES TO EDUCATIONAL BACKGROUND
MACHINE SHOP

RESPONSE	PASS	FAIL	SUM	%P/F
<11YRS	1	0	1	
HIGH SCH	29	18	47	23%
ASSO DEG	17	15	32	6%
BACH DEG	9	1	10	80%
GRAD WRK	4	0	4	
TOTAL	60	34	94	28%
Chi-square=7.48	degrees of freedom=4		p=.1	

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore the result was not statistically significant at the .05 level.

Table 82 shows the relationship of the number of months of nondegree training beyond high school in programs such as apprenticeships, on-the-job training, or professional institutes to passing and failing scores on the practical examination. Candidates with from three to twelve months of training had a passing to failing ratio of zero, compared to the overall ratio of negative twenty-five percent.

TABLE 82
RELATIONSHIP OF EDUCATIONAL BACKGROUND TO PRACTICAL TEST SCORES
MACHINE SHOP

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	2	8	10	-60%
<3MOS	0	2	2	
3-6MOS	6	6	12	0
7-12MOS	3	3	6	0
>12MOS	14	23	37	-24%
TOTAL	25	42	67	-25%
Chi-square=3.7	degrees of freedom=4		p=.4	

When the Chi-square test was applied, however, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Table 83 summarizes the Chi-square values obtained for the occupation Machine Shop.

TABLE 83
SUMMARY OF CHI-SQUARE VALUES FOR MACHINE SHOP

QUESTION	CHI-SQUARE	DF	SIGNIFICANCE
	WRITTEN TEST		
T3	8.39	4	.07
E2	7.48	4	.1
W1	1.15	4	.9
	PRACTICAL TEST		
W1	8.16	4	.08
T4	4.29	3	.2
E1	3.7	4	.4

The candidate most likely to succeed on the written examination would have six to twelve years of work experience, up to one year of experience teaching vocational, occupational, technical, business, or industrial arts courses at the secondary level, and a bachelor's degree.The candidate most likely to succeed on the practical examination would have nineteen to twenty-four years of work experience, up to one year of experience teaching vocational courses at the secondary level, and three to twelve months of nondegree training beyond high school.

Metal Trades

Information presented in this section answers the research questions for the occupation metal trades. The data presented is a composite of three test areas: metal fabrication, sheet metal, and precision sheet metal.

> Research question #1: Is there a relationship between work experience and occupational comptency as measured by the Massachusetts Vocational Competency examination?

Table 84 shows the number of candidates taking the Metal Trades examinations, and their responses to the question about work experience. It should be noted that a minimum of six years of work experience is mandatory for candidates to be eligible to take this exam. However, one candidate indicates less than six years of experience. Forty-seven percent of the candidates taking the written exam have six to twelve years of experience, and an additional twenty-one percent have thirteen to eighteen years. Fifty-one percent of those taking the practical examination have from six to twelve years of trade experience.

TABLE 84
RESPONSES REGARDING WORK EXPERIENCE FOR METAL TRADES

RESPONSE	WRITTEN		PRACTICAL	
	n	%	n	%
<6YRS	1	2.3	1	2.7
6-12YRS	20	46.5	19	51.4
13-18YRS	9	20.9	6	16.2
19-24YRS	4	9.3	3	8.1
≥24YRS	9	20.9	8	21.6
TOTAL	43	100	37	100

Table 85 shows the number of candidates passing and failing the written examination and their responses to the question about work experience. Thirty-five percent of those who took the written examination failed, while sixty-five percent passed. This resulted in a passing to failing ratio of thirty percent. Those candidates having over twenty-four years of experience had the highest passing to failing ratio: seventy-eight percent. There were not enough candidates in the first and fourth intervals to compute the ratio.

TABLE 85
RELATIONSHIP OF WORK EXPERIENCE TO WRITTEN TEST SCORES/METAL TRADES

RESPONSE	PASS	FAIL	SUM	%P/F
≤6YRS	1	0	1	
6-12YRS	13	7	20	30%
13-18YRS	5	4	9	11%
19-24YRS	1	3	4	
≥24YRS	8	1	9	78%
TOTAL	28	15	43	30%
Chi-square =3.8		degrees of freedom=4		p=.2

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Table 86 shows the number of candidates passing and failing the practical examination, and their responses to the question about work experience. Forty-three percent of those taking this examination failed, while fifty-seven percent passed. This results in a passing to failing ratio of fourteen percent. Those candidates with thirteen to

eighteen years of work experience had a passing to failing ratio of thirty-three percent. There were not enough candidates in the first and fourth intervals to compute a ratio.

TABLE 86
RELATIONSHIP OF WORK EXPERIENCE TO PRACTICAL TEST SCORES/METAL TRADES

RESPONSE	PASS	FAIL	SUM	%P/F
≤6YRS	1	0	1	
6-12YRS	11	8	19	+16
13-18YRS	4	2	6	+33
19-24YRS	1	2	3	
≥24YRS	4	4	8	0
TOTAL	16	21	37	+14
Chi-square=1.83		degrees of freedom=4		p=.8

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the results were not statistically significant at the .05 level.

Research Question #2: Is there a relationship between teaching experience and occupational competency as measured by the Massachusetts Vocational Competency examination?

Table 87 shows the number of candidates taking the Metal Trades examinations and their responses to the question about teaching experience. Sixty percent of those taking the written test had no teaching experience, while an additional fourteen percent had less than one year. Seventy-three percent of those taking the practical exmination had no teaching experience, while an additional thirteen percent had up to one year.

TABLE 87
RESPONSES REGARDING TEACHING EXPERIENCE FOR METAL TRADES

RESPONSE	WRITTEN n	WRITTEN %	PRACTICAL n	PRACTICAL %
NONE	26	60.5	27	73
<1YR	6	14.0	5	13.5
1-3YRS	5	11.6	1	2.7
4-6YRS	2	4.7	1	2.7
≥6YRS	4	9.3	3	8.1
TOTAL	43	100	37	100

Table 88 shows the number of candidates passing and failing the written examination and the number of years teaching vocational, occupational, technical, business, or industrial arts courses at the secondary level. Candidates who had up to one year of teaching experience had a passing to failing ratio of thirty-three percent, compared to an overall ratio of thirty percent.Those candidates with one to three years of teaching experience had a passing to failing ratio of sixty percent. There were not enough candidates in the fourth and fifth intervals to compute a ratio.

TABLE 88
RELATIONSHIP OF TEACHING EXPERIENCE TO WRITTEN TEST SCORES/METAL TRADES

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	17	9	26	31%
<1YR	4	2	6	33%
1-3YRS	4	1	5	60%
4-6YRS	2	0	2	
≥6YRS	1	3	4	
TOTAL	28	15	43	30%
Chi-square=9.46		degrees of freedom=4		p=.4

When the Chi-square test was applied, the value obtained was not larger than the critical value for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Table 89 shows the number of candidates passing and failing the practical examination and their responses to the number of years of experience teaching vocational courses at the secondary level. Candidates having up to one year of teaching experience had a passing to failing ratio of twenty percent, compared to an overall ratio of fourteen percent. There were not enough candidates in the third, fourth, and fifth intervals to compute a ratio.

TABLE 89
RELATIONSHIP OF TEACHING EXPERIENCE TO PRACTICAL TEST SCORES
METAL TRADES

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	13	14	27	-3%
<1YR	3	2	5	+20%
1-3YRS	1	0	1	
4-6YRS	1	0	1	
≥6YRS	3	0	3	
TOTAL	21	16	37	+14%
Chi-square=4.64		degrees of freedom=4		

When the Chi-square test was applied, however, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Research question #3: Is there a relationship betwween educational background and occupational competency as measured by the Massachusetts Vocational Competency Examination?

Table 90 summarizes the number of candidates taking the Metal Trades examinations and their responses to the question about educational background. It should be noted that a high school diploma was the minimum educational requirement for a candidate to be eligible to take this test. Even so, two candidates indicated eleven years of education or less. Fifty-three percent of the candidates taking the written test had a high school diploma, while an additional thirty-three percent had an associates degree. Sixty-four percent of those taking the practical examination had more than one year of nonedegree training beyond high school.

TABLE 90
RESPONSES REGARDING EDUCATIONAL BACKGROUND FOR METAL TRADES

RESPONSE	WRITTEN n	%	RESPONSE	PRACTICAL n	%
≤11YRS	2	4.7	NONE	3	8.3
HIGH SCH	23	53.5	<3MOS	2	5.6
ASSO DEG	14	32.6	3-6MOS	3	8.3
BACH DEG	1	2.3	7-12MOS	5	13.9
GRAD WRK	3	7.0	≥12MOS	23	63.9
TOTAL	43	100		36	100

Table 91 shows the relationship between the number of years of formal education in a degree granting institution and the number of candidates passing and failing the written examination. Candidates with a high school education had a passing to failing ratio of forty-eight percent, compared to an overall percentage of thirty

percent. There were not enough candidates in the first, fourth and fifth intervals to compute a percentage.

TABLE 91
RELATIONSHIP OF EDUCATIONAL BACKGROUND TO WRITTEN TEST SCORES
METAL TRADES

RESPONSE	PASS	FAIL	SUM	%P/F
<11YRS	1	1	2	
HIGH SCH	17	6	23	48%
ASSO DEG	7	7	14	0
BACH DEG	1	0	1	
GRAD WRK	2	1	3	
TOTAL	28	15	43	30%
Chi-square=2.63		degrees of freedom=4		P=.6

When the Chi-square test was applied, the value obtained was not larger than the critical value (9.48) for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Table 92 shows the relationship between the number of months of nondegree training beyond high school in programs such as apprenticeships, on-the-job training, or professional institutes and passing and failing scores on the practical examinations. Candidates having a year or more of such training had the best passing to failing ratio, thirteen percent, compared to an eleven percent ratio overall. There were not enough candidates in the first three intervals to compute a ratio.

TABLE 92
RELATIONSHIP OF EDUCATIONAL BACKGROUND TO PRACTICAL TEST SCORES
METAL TRADES

RESPONSE	PASS	FAIL	SUM	%P/F
NONE	1	2	3	
<3mos	2	0	2	
3-6mos	3	0	3	
7-12mos	1	4	5	-60%
≥12mos	13	10	23	+13%
TOTAL	20	16	36	+11%
Chi-square=7.16	degrees of freedom=4		p=.1	

When the Chi-square test was applied, the value obtained was not larger than the critical value for a table with four degrees of freedom. Therefore, the result was not statistically significant at the .05 level.

Table 93 summarizes the Chi-square values obtained for the occupation metal trades.

TABLE 93
SUMMARY OF CHI-SQUARE VALUES FOR METAL TRADES

QUESTION	CHI-SQUARE	DF	SIGNIFICANCE
	WRITTEN TEST		
W1	5.97	4	.2
T3	4.4	4	.4
E2	2.93	4	.6
	PRACTICAL TEST		
E1	7.16	4	.1
T4	4.64	4	.3
W1	1.83	4	.8

The candidate most likely to succeed on the written examination would have one to three years of experience teaching vocational, occupational, technical, business, or industrial arts courses at the secondary level, over twenty-four years of work experience, and a high school diploma. The candidate most likely to succeed on the practical examination would have more than one year of nondegree training such as apprenticeship, on-the-job training, or professional institutes, up to one year of experience teaching vocational courses at the secondary level, and thirteen to eighteen years of work experience.

CHAPTER VI

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Summary

A critical shortage of vocationally approved trade and industry teachers exists in Massachusetts in several occupational areas. It is the responsibility of the Office of Professional Development, Division of Occupational Education to maintain a pool of qualified and approved teachers to meet the requirements of Chapter 74 schools and programs throughout the Commonwealth. However, in the Spring of 1984, fifty percent or more of the candidates in fourteen of the forty-two occupational areas subject to the Massachusetts Vocational Competency Testing Program were teaching on a Temporary Conditional Approval.

The question of how much work experience is necessary has plagued vocational educators for years. The assumption is that the more experience that one has in the field, the better qualified that person will be to teach those skills. Massachusetts has held rigidly to the requirement of six years of recent full-time experience for all vocational trade and industrial education teachers regardless of the trade area. But little factual information exists on how many

years of trade experience is appropriate for auto mechanics teachers as compared to electronics teachers.

Background of Competency Testing

A number of studies were undertaken during the sixties and seventies to try to determine the relationship between the background characteristics and the person's occupational competency. The results of these studies was inconclusive. There is agreement that the requirement for valid work experience has been the cornerstone of certification of vocational teachers since the Smith-Hughes Act of 1917. In federally-reimbursed programs such as Chapter 74 in Massachusetts, the law is clear that only persons with practical experience be allowed to teach. However the amount is variable from 3 to 8 years. Massachusetts has one of the higher requirements--6 years--in terms of years of work experience. This experience is carefully evaluated by the Office of Professional Development, Division of Occupational Education and confirmed by vocational competency testing.

In 1978, Massachusetts began to consider upgrading the competency testing effort then in place. The Division of Occupational Education suspended the testing program until the situation could be carefully studied. Fitchburg State College was awarded funding under a federal grant for the 1979/80 year. On January 15, 1980, with the hiring of a program coordinator, the Massachusetts Vocational Competency Testing Program began full operation. Work under this grant was specifically

directed toward providing a reliable and valid testing program for vocational trade and industrial education teachers. Currently work is underway to update the existing tests in 45 trade areas and to develop new tests as the need becomes evident and to administer these test to the nearly three hundred eligible persons yearly. This study was undertaken based upon the data obtained during the administration of this testing program.

Purpose of this study

The primary purpose of this study was to determine the strength and direction of the relationship between the occupational competence of the candidate for vocational teacher approval as measured by his/her scores on the Massachusetts Vocational Competency Examinations and the number of years of occupational experience of the individual.

The secondary purpose was to establish whether or not there is a relationship between teaching experience, educational background and scores on the Massachusetts Vocational Competency Examinations. An examination of several kinds of teaching experiences, and a variety of educational backgrounds was necessary to establish which one, respectively, was the most influential with regard to test scores.

Research questions

First, what relationship existed between the number of years of work experience and scores on the Massachusetts Vocational Competency examinations?

Second, what relationship existed between the amount and kind of teaching experience the candidate has and his/her scores on the Massachusetts Vocational Competency Examinations?

Third, what was the relationship between the candidate's educational level and scores on the Massachusetts Vocational Competency Examinations?

Finally, was there a relationship between all of these factors taken together and scores on the Massachusetts Vocational Competency Examinations?

There were two distinct parts of this four-year study. The first part involved a sample of all candidates across all trade areas. Regression analysis was used to determine the type of teaching and educational experience that had the most pronounced influence on written and practical examination scores. When one experience from each of the three research areas was isolated, regression analysis was used again to determine the effect on scores of all three factors.

The second part of this study involved a sample consisting of seven trades. Scores were classified as either a pass or a fail, and Chi-Square analysis was used to determine whether passing or failing the test was independent of the three kinds of background experiences. In addition, the correlation between the written and practical test scores was investigated. Finally, the profile of the successful candidate in each trade is drawn by means of an examination of the passing to failing ratio.

Discussion

Written examination

Regression analysis was applied to responses to the five questions about teaching experience from the demographic survey. The results of this analysis show that the teaching experience which had the largest degree of association with written test scores was the number of years teaching vocational, technical, occupational, business or industrial arts courses at the secondary level. This result was significant at the .01 level.

Regression analysis was applied to the responses to the four questions about educational background from the demographic survey. The results of this analysis show that the educational experience which had the largest degree of association with written test scores was the number of years of formal education. This result was significant at the .05 level.

Regression analysis was applied to the one question about work experience. The result was a very small, negative value. This finding was not significant. Since there was only one question about work experience, the responses to this question were included in all analyses throughout the study.

When each variable was analyzed separately, teaching experience had the largest value. The second largest value was found for educational background. The value obtained from the work experience variable was the smallest. When entered into a regression equation to

analyze the interaction of the three variables, the results appear to be less conclusive. As work experience increases, test scores decrease slightly; as teaching experience increases, test scores increase slightly; as education increases, test scores increase substantially.

A general expression was given as follows: the written test score is associated with sixty percent education, ten percent teaching experience, and thirty percent work experience.

The Chi-square test of independence was then applied to determine if passing or failing the written test was independent of each of the independent variables. Written test scores were found to be independent of the number of years of work experience. Written test scores were significantly related to teaching experience and educational background.

Practical Examination

Regression analysis was applied to the responses to the four questions about educational background from the demographic survey. The results of this analysis show that the educational experience which ahd the largest degree of association with practical test scores was the number of months in post-high school nondegree training programs such as on-the-job training or professional institutes. This result was significant at the .02 level.

Regression analysis was applied to the responses to the five questions about teaching experience from the demographic survey. The results of this analysis show that the teaching experience which had the largest degree of association with practical test scores was the

number of years teaching vocational courses in the trade area of the test at the secondary level. This result was not statistically significant.

Regression analysis was applied to responses to the one question about work experience. The result was a small negative value, and was not statistically significant.

When each variable was analyzed separately, the value obtained for teaching experience was the largest. The second largest value was found for educational background, and work experience had a small negative value. When all three were entered into a regression equation to analyze the interaction of the three variables, the result was that education became the strongest of the three. As work experiences increases, practical tes scores decrease slightly. as teaching experience increases, test scores increase slightly. As education increases, test scores increase significantly.

A general expression of association was given as follows: practical test scores are mathematically related to fifty percent education, twenty percent teaching experience, and thirty percent work experience.

The Chi-square test of independence was applied to determine if passing or failing the practical test was indenpendent of each of the three variables. The results of this test were inconclusive. The values of the Chi-square were not large enough to indicate a relationship existed between practical test scores and the independent variables, and yet not small enough to indicate independence.

Correlation of Written and Practical Examinations

The Pearson correlation coefficient was generated to examine the relationship between the written and ractical examination scores. The value obtained was so small that it could be interpreted to mean a lack of relationship.This result was statistically significant at the .05 level.

Trade by Trade Analysis

Chi-square analysis was applied to the numbers of those passing and failing the written and practical tests and the responses to the three independent variables. Most of the results were not statistically significant. However, three were within acceptable limits. It was found that passing or failing the Electronics written test and the number of years of work experience were not independent. this result was significant at the .05 level. It was found that passing or failing the electricity practical test was not independent of the number of years of teaching experience. This result was significant at the .02 level. It was found that passing or failing the Culinary Arts practical test was not independent of the educational background of the candidate. This result was significant at the .01 level.

Through the use of the passsing to failing ratio, profiles of the successful candidate in each trade were drawn. These are summarized in Table 95.

TABLE 95
SUMMARY TABLE

TRADE	WORK EXPERIENCE		TEACHING EXPERIENCE		EDUCATIONAL LEVEL	
	WRITTEN	PRACTICAL	WRITTEN	PRACTICAL	WRITTEN	PRACTICAL
AUTO REPAIR	>24YRS	13-18YRS	1-3YRS	<1YR	GRAD WRK	>12MOS
CARPENTRY	≥24YRS	19-24YRS	>6YRS	≤1YR	GRAD WRK	≤3MOS
CULINARY	19-24YRS	6-12YRS	NONE	NONE	ASSO DEG	NONE
ELECTRICAL	13-18YRS	6-12YRS	<1YR	≤1YR	ASSO DEG	3-6MOS
ELECTRONICS	6-12YRS	13-24YRS	≤1YR	≤1YR	HIGH SCH	>12MOS
MACHN SHP	6-12YRS	19-24YRS	4-6YRS	≤1YR	HIGH SCH	3-12MOS
METALS	≥24YRS	13-18YRS	1-3YRS	≤1YR	HIGH SCH	≥12MOS

In general, this study asked more questions than were answered. Much of the research was inconslusive, and a lot of it was statistically not significant. However, this study certainly points the way for future work to be done in this area. What was conclusive, was the relationship between teaching experiences and educational background to written test scores. This is consistent with previous research, and appeals to one's common sense.

The influence of teaching experience on test scores is to be expected. During the first year of teaching, the candidate has had some exposure to the print resources available, and begun to think about the trade in terms of the structured approach necessary to teach a concept. The teaching experiences indicated by the research give a clue to the breadth of knowledge necessary for sucess as a vocational teacher.

The influence of the number of years of formal education on sucess on the written test is to be expected. Reading, writing, and critical thinking skills are enhanced by increased levels of education. However, the educational experience most related to success on the practical test is interesting. That the amount of time spent in nondegree programs dedicated to technical training has a direct influence on practical test scores is an apealing concept.

Although the result is not statistically significant, the negative effect of work experience on both written and practical test scores is consistent with the findings of Whitener (1981). It would appear that as the number of years of work experience nears or surpasses twenty-four, test scores in general tend to decrease.

Some exceptions to this are shown in the trade by trade analysis, however.

The successful candidate on the written test in Auto Repair, Carpentry, and Metal Trades had over twenty-four years of trade experience. In the case of Auto Repair, and Carpentry this was coupled with advanced college preparation. In the case of Electronics, the number of years of work experience is significantly related to written test scores.

There are two points that need to be examined which surfaced during the examination of the research.

1) The Division of Occupational Education should give serious consideration to requiring a pre-service program for prospective teachers coming from industry. This would provide them with the basic tools for teaching before they enter the classroom.

2) The Division of Occupational Education should give serious consideration to the development of a Basic Skills inventory to be administered to prospective teachers at the time of the written examination.

Recommendations

Based on the findings of this study, it is clear that the six year work experience requirement is not the single best criteria for the Approval of vocational teachers in the Commonwealth of Massachusetts. Therefore, it is recommended that:

1. The Division of Occupational Education consider the results of this study when the eligibility requirements for vocational teacher Approval are revised.

   A. Priority be given to candidates who have had training beyond the high school level in nondegree programs such as apprenticeships, on-the-job training, or professional institutes and who had one or more advanced degrees.

   B. A fixed number of years of work experience no longer be used as the sole criteria for determining eligibility for Approval.

2. Research is continued in the three areas discussed in this study.

   A. The interval from zero to six years of work experience be researched thoroughly in relation to test scores.

   B. The interval six to twelve years of work experience be researched thoroughly in relation to test scores.

   C. An updated version of the Background Questionnaire be administered at the time of the written test.

3. The remaining occupations covered by the Massachusetts Vocational Competency Testing Program are subjected to the kind of statistical inquiry that was used in this study.

A. The trade by trade analysis be extended to cover all test areas where there are a sufficient number of candidates to assure meaningful statistics.

B. The Division of Occupational Education consider a variable number of years of work experience to accomodate the differences between the trade areas when the criteria for vocational teacher approval are revised.

No attempt was made in this research to extend the conclusions to account for success in the classroom as a product of success on the Vocational Comeptency Examination. Resesarch is needed in this area for the issue of whether trade competency is enough to assure success in the classroom is still open to debate.

BIBLIOGRAPHY

Advisory Council on Vocational Education. Vocational Education: The Bridge Between Man and His Work. Washington: Department of Health, Education and Welfare, 1967.

Allen, David. "Instruction." The Philosophy for Quality Vocational Education Programs, in Fourth Yearbook of the American Vocational Association. Washington, D.C. American Vocational Association, Inc., 1974.

Ary, Donald; Jacobs, Lucy C.: and Razavieh, Asghar. Introduction to Research in Education. New York: Holt, Rinehart, and Winston, Inc. 1972.

Barlow, Melvin. History of Industrial Education in the United States. Peoria, Illinois: C. A. Bennett, 1976.

Bayne, G. Keith. "Occupational Competence Involves More Than Skills and Knowledge."Journal of Industrial Teacher Education, 1976

Blalock, Hubert M, Jr.,Social Statistics, Revised Second Edition, New York: McGraw-HIll Book Co., 1979.

Burrows, J. and Groneman, Nancy. The Purpose of and Competencies Developed Through Occupational Experience for Vocational Education Teachers. Lincoln: University of Nebraska, 1976.

Cap, Orest. "A Look into Occupational Competency Testing." Canadian Vocational Journal 10 (February 1975): 26-27.

Chalupsky, A. B.; Phillips-Jones, L.; Danoff, M.N.; Competency Measurement in Vocational Education: A Review of the State of the Art, Palo Alto, CA: American Institute for Research, June 1981

Chapter 74 Regulations, Law of Massachusetts, Masachusetts Department of Education, 1977

Cline, Dwight. "Predicting Effectiveness in T & I Teachers." American Vocational Journal, 52 (November 1977): 60-63.

Corman, Myron N. "Testing the Occupational Competency of T and I Teachers." American Vocational Journal 48 (January 1973).

Covey, James W. "The Testing of Four Major Dimenions of Professional Preparation Models for the Development of Vocational-Technical Education." PH.D. dissertation, University of Wisconsin, 1973.

Cumulative National Subscore Norms, 1974-1978. Cited by Leon S. Tunkel and Raymond S. Klein, An Overview of the NOCTI Program and Examinations. Albany, NY: National Occupational Competency Testing Institute, 1979.

Ellis, William G. "The Relationship of Related Work Experience to Teaching Success of Beginning Business Teachers." Ph.D. dissertation, The Pennsylvania State University, 1968.

Evans, Rupert N. Foundations of Vocational Education. Columbus OH: Charles E. Merrill Publishing Company, 1971.

Ford, Joseph A. "History of Vocational Teacher Certification in the United States." In Seymour T. Brantner (Ed.). Certification of Vocational Technical Educators. University Park, Pennsylvania: Pennsylvania State University, 1974.

Freirer, John L. "Has Vocational Teaching Become a Profession?" Industrial Arts and Vocational Education, 54 (November, 1965).

Gallington, Ralph O. and Haskell, Roger W. "How to Test the Accountable Vocational Teacher." Industrial Arts and Vocational Education, 61 (April, 1972).

Gillie, Angelo C. Principles of Post Secondary Vocational Education. Columbus, Ohio: Charles E. Merrill Pubishing Company 1973.

Gutchen, Dale and Mast, William. "College Credit for Non-Traditional Learning Experiences: An Historical Perspective." Journal of Industrial Teacher Education, 14 (2) 1977, pp 56-62.

Handbook for Area Test Center Organization & Administration, Albany, New York: National Occupational Competency Testing Institute.

Hathaway, W.E., "Testing teachers to ensure competency; the state of the art." Paper given at the annual meeting of the American Educational Research Association, Boston, April 1980.

Hoyman, Ronald D. The Development of a Series of Recommendations and Procedures Required in Administration of a Centralized Program Pennsylvania: The Pennsylvania State University, May 1978.

Impellitteri, Joseph T. "An Analysis of the Occupational Program at the Pennsylvania State University from 1944 to 1965." Research report prepared for the Pennsylvania State University, 1965.

Johnson, H.C. Jr., "Court, craft and competence: a re-examination of 'teacher evaluation' procedures.". Phi Delta Kappan 57 (May 1976) pp. 606-610.

Kazanas, C. and Kieft, D. An Experimental Project to Determine more Effective Vocational Teacher Certification Procedures in Michigan by Competency Examinations. Bethesda, MD: ERIC Document Reproduction Services, 1966.

Kapes, J. T. and Pawloski, V. Characteristics of Vocational-Technical Instructors and Their Relationship to Student Shop Achievement. Research Report, Vocational Development Study Series. Monograph No. 17. University Park, Pennsylvania: The Pennsylvania State University, 1974.

Klehm, Merwyn A. "The Status of the Certification Requirements for Trade and Industrial Teachers in the United States." Ph.D. dissertation, The Ohio State University, 1974.

Klein, Raymond S. Some Selected Technical Issues Related to Performance Testing. Albany, New York: National Occupational Competency Testing Institute, October 1979.

Lacy, Annell. "Teacher Job Satisfaction: Factor and Implication." The Delta Ph Epsilon Journal 151 (August 1973).

Lareau, E.H. Learning the Teaching Trade; a study of Vocational Testing." Teacher Training in Masachusetts. Final Report, Division of Occupational Education, Boston, MA 1982

McAlister, Patricia. "A Study of Occupational Experience of Individuals Who Have Successfully Participated in the Occupational Competency Program Administred by the Department of Vocational Education at The Pennsylvania State University." Report prepared for the Department of Vocational Education, The Pennsylvania State University, 1973.

McMahon, Gordon G. "The Growing Importance of Occupational Competency Testing.' American Vocational Journal 46 (May 1971): P46.

Milan, Joseph E. "Comparisons of Colorado Trade and Industrial Teachers." PH.D. dissertaton, Colorado State University 1972.

Miller, Aaron J. and Roehrich, Robert R. The Certification of Vocational Education Personnel. A Report of the AVA ad hoc Committee on Professional Standards. Washington D.C.: American Vocational Association, October 1977. (ERIC ED 160 754).

Minium, Edward W.,Statistical Reasoning in Psychology and Education, New York: John Wiley and Sons, 1978.

Moss, Jerome, Jr. "Assumptions Underlying Preservice Programs for Beginning Level Vocational Teachers." In Rupert N. Evans and David B. Terry (Eds.). Changing the Role of Vocational Teacher Education. Bloomington: McKnight and McKnight Publishing Company, 1971.

National Association for Trade and Industrial Education. Trade and Industrial Education Philosophy and Standards of Excellence. Falls Church, Virginia: NATIE, 1975.

National Occupational Competency Testing Institute. "Bulletin of Information for Candidates." Albany, New York, 1974.

National Occupational Competency Testing Institute, Bulletin of Information for Candidates. Albany, New York: NOCTI, September 1978.

National Occupational Competency Testing Institute. "Handbook for Area Test Center Organization and Admnistration." Albany, New York, 1980.

Nie, Norman H.; Hull, C. Hadali; Jenkens, Jean G.; Stienbrenner, Korin; and Bent, Dale H. SPSS Statistical Package for the Social Science. 2nd Ed. New York: McGraw Hill Book Company, 1970.

Ohio Trade and Industrial Education Services. Factors Contributing to Student Achievement. Columbus, OH: The Ohio State University, 1965.

Ohio Trade and Industrial Education Services. Trade and Industrial Education Achievement Test Prgram. Columbus, OH: The Ohio State University, 1970.

Olivo, C. Thomas, and Klein, Raymond S. NOCTI Technical Supplement; 5th Ed. Albany, New York: National Occupational Competency Testing Institute, November, 1979.

Olivo, C. Thomas, "NOCTI Precursors and Plans." School Shop, 39 (8) April, 1980.

Olivo, C. Thomas. "NOCTI: Precusors, and Plans." School Shop 39 (April 1980): P60-61.

Oppenheim, A.N., Questionnaire Design & Attitude Measurement, New York: Basic Books, Inc. Publishers, 1966.

Panitz, Adolf. "National Occupational Competency Exams for Future Teachers." American Vocational Journal, 50 (2) 1979.

Panitz, Adolf and Olivo, C. Thomas. The State of the Art of Occupational Competency Testing. New Brunsick, New Jersey: Rutgers, The State University, June 1970.

Panitz, Adolf and Olivo, C. Thomas. Handbook for Developing and Administering Occupational Competency Tests. Albany, New York: National Occupational Competency Testing Institute 1971.

Panitz, Adolf and Olivo, C. Thomas. Handbook for Developing and Administering Occupational Competency Testing. New Brunswick, NJ: Rutgers, The State University of New Jersey, 1971.

Popham, W. James and Sirontnik, Kenneth A. Educational Statistics: Use and Interpretation 2nd Ed. New York: Harper and Row Publishers, 1973.

Prosser, Charles A. and Quigley, Thomas H. Vocational Education in a Democracy. Chicago: American Technical Society, 1949.

P.L. 64-347 Smith-Hughes Act, Section 12 as printed in Hawkins, Prosser, and Wright. Development of Vocational Education. Chicago: American Technical Society, 1951.

Ramp, Wayne S. "Vocational Certification: A National Overview." In Seymour T. Brantner (Ed.) Certification of Vocational Technical Educators. University Park, Pennsylvania: The Pennsylvania State University, 1974.

Rask, Glen and Wyatt, Windol. The Effect of Vocational Instructors' Occupational Experience and Experience Recency on Instructors' Attitudes and Proficiency. Fort Collins, CO: Colorado State University 1976.

Reed, Joe L. "The Recruitment and Training of Vocational Teachers." In Von H. Robertson (Ed.) Guidelines for the Seventies: 1976 Yearbook, Trade and Industrial Division, American Vocational Association. Chicago: American Technical Society, 1967.

Reeder, Ronald C. "Teacher Competencies and Certification." American Vocational Journal, Volume 48, Number 3, (March, 1973).

Resnik, Harold S. and Gardner, David C. An Analysis of National Certification Requirements and Professional Development Standards for Vocational Education Personnel. Boston: Boston University, 1977. (Ed 146 410).

Resnick, Harold S. and Gardner, David C., "Certification Requirements for Vocational Education Personnel: A National Survey." Journal of Industrial Teacher Education 16 (winter 1979): P11-18

Rumpf, Edwin L. "A Basis for the Selection of Vocational Industrial Education Teachers for Employment in Pennsylvania.: Ph.D. dissertation, The Pennsylvania State University, 1954.

Runyon, Richard P. and Haber, Audrey, Fundamentals of Behavioral Statistics. 3rd ed. Reading, MA: Addison-Wesley Publishing Co. 1976.

Schaefer, Carl, 'NOCTI." NOCTI News. Princeton, NJ: National Occupational Competency Testing Institute, 1974.

Shoemaker, Bryl. "How to be Accountable in Trade and Industrial Education." American Vocational Journal 46 (February 1971) P83-86.

Simmons, Kenneth L. "The Status and Trends of Occupational Competency Testing on a National Level With Implications for the State of Mississippi." Ph.D. dissertation, Mississippi State University, 1977.

Sjogren, Douglas. "Evaluation of Vocational Teacher Education." In Rupert N. Evan and David B. Terry (Ed.) Changing the Role of Vocational Teacher Education. Bloomington: McKnight and McNight Publishing Company, 1971.

Smith, Jay T., Sr. "A Study of Relationships Between Selected Characteristics of Shop and Laboratory Instructors and Student Achievement in Vocational and Technical Education." Ph.D. dissertation, North Carolina State University, 1971.

Storm, George. "The Successful Teacher in Technical Education: The Preparation of the Successful Teacher." Ed.D. dissertation, Oregan State University, 1965.

Tunkel, Leon S. and Klein, Raymond S. An Overview of the NOCTI Program and Examinations. Albany, NY: National Occupational Competency Testing Institute, 1979.

Tunkel, Leon S. and Klein, Raymond S. NOCTI Technical Supplement. Albany, New York: National Occupational Competency Testing Institute, September 1978.

Tunkel, Leon S. and Klein, Raymond S. Vocational Competency Testing. Project Final Report. Albany, New York: National Occupational Competency Testing Institute, October 1976.

Welch, Frederick G. and Garner, C. William. "Occupational Experience: How Much is Enough? "American Vocational Journal 51 (September 1976): P34-35

White, T. R. "The Area Vocational School: An Emerging Institution." Phi Delta Kappan 53 (March 1971).

Whitener Scott D. "NOCTI Occupational Competency Examination Scores and Their Relationship to Occupational Experience, Teaching Experience, and Educational Level."dissertation, University of Michigan, 1981.

Wiersma, William, Research Methods in Education, An Introduction, Second Edition, Itasca, Illinois: Peacock Publishers, Inc., 1975.

APPENDIX A
Vocational Competency Test

Massachusetts Department of Education
Division of Occupational Education

BACKGROUND INFORMATION QUESTIONNAIRE

The folliwng questions are to be answered on the all purpose answer sheet, starting with question 151. Enter your answer by filling in the appropriate circle, as previously described. the answer to these questions are voluntary and all information will be kept confidential, as stated in the general instructions. Your cooperation is greatly appreciated to ensure continued improvement in the quality of these tests.

Fill in only ONE Reponse to each question. Multiple answers cannot be read by the computer.

W1/151. How many years TOTAL have you worked in the trade area of the test you are taking? (Including trade time in the military.)

A. Less than 6 years
B. 6 to 12 years
C. 13 to 18 years
D. 19 to 24 years
E. More than 24 years

T1/152. How many years TOTAL experience have you had as a teacher or training instructor? (Include all teaching for any subject at any level for any institution or organization. For part-time teaching, estimate using 1 day per week for a year is equal to 2 months full-time.)

A. No teaching experience
B Less than 1 year
C. 1 to 3 years
D. 4 to 6 years
E. More than 6 years

T2/153. How many years of secondary level teaching experience do you have? (Include any subject in grades 7 - 12 in both public or private schools.)

A. No experience
B. Less than 1 year
C. 1 to 3 years
D. 4 to 6 years
E. More than 6 years

T3/154. How many years experience have you had teaching vocational, technical occupational, business or industrial arts courses at the secondary level (grades 7 - 12)? (Include both public or private schools.)

A. No experience
B. Less than 1 year
C. 1 to 3 years
D. 4 to 6 years
E. More than 6 years

T4/155. How many years experience have your had teaching vocational courses in the trade area of this test at the secondary level (grades 7 -12)? (Include both public or private schools.)

A. No experience
B. Less than 1 year
C. 1 to 3 years
D. 4 to 6 years
E. More than 6 years

T5/156. How many years experience have you had teaching vocational courses in the trade area of this test at other than the secondary level (grades 7 - 12)? (Include all institutions or organizations, e.g. adult evening school, military school, etc.)

A. No experience
B. Less than 1 year
C. 1 to 3 years
D. 4 to 6 years
E More than 6 years

157. How did you receive your high school diploma?

A. Public trade or vocational school
B. Private trade or vocational school
C. Public comprehensive school
D. Private comprehensive school
E. GED, military, or other

E1/158. How much formal training, in addition to high school courses, have you had in nondegree programs? (Examples include apprenticeships, OJT. professional training institutions, etc. For part-time training, estimate using 1 day per week for a year as equal to 2 months full-time.)

A. No training, other than high school
B. Less than 3 months
C. 3 to 6 months
D. 7 to 12 months
E. More than one year

E2/159. How many years of formal education have you completed? (Include all institutions that grant a diploma or degree.)

A. Some high school or less (11 years or less)
B. Completed high school (12 years)
C. Associate Degree or some college (13 - 14 years)
D. Bachelor's Degree (16 years)
E. Graduate work (more than 16 years)

E3/160. How many TOTAL undergraduate credits do you have in all vocational education coursework?

A. No credits
B. Less than 6
C. 6 to 12
D. 13 to 21
E. More than 21

E4/161. How many TOTAL undergraduate credits do you have in vocational education course work specific to YOUR TRADE AREA?

A No credits
B. Less than 6
C. 6 to 12
D. 13 to 21
E. More than 21

162. What is your CURRENT employment status?

A. Unemployed
B. Employed in trade area of this test
C. Employed in another trade area
D. Full-time student
E. Teaching

163. Are you CURRENTLY licensed in you trade or profession?

A. Yes
B. No
C. Licensing unnecessary

164. Are you a veteran of the U.S. Armed Forces?

A. Yes
B. No

165. Are you currently teaching on a WAIVER in a secondary school (grades 7-12) in the trade area of this test?

A. Yes
B. No